

# HP Basic Instruments Catalog 1997

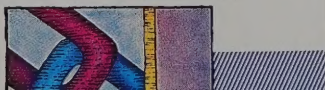


**H P D I R E C T**

Practical solutions  
for real-life  
test and measurement  
challenges.

*Oscilloscopes*  
*Logic Analyzers*  
*Mixed-Signal Test*  
*Multimeters*  
*Function Generators*  
*Counters*  
*Power Supplies*  
*Connectivity*  
*RF Products*  
*Extra Performance*

HP BenchLink





## **Within budget, without compromise.**

**Some interesting things happened when we made engineers responsible for lowering the costs of our basic instruments. They didn't skip QA testing, compromise performance or resort to cheap materials.**

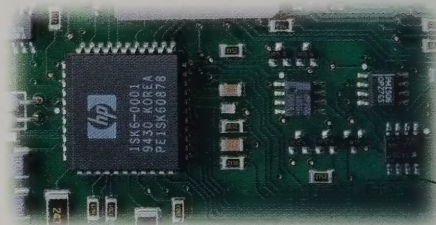
**They designed new integrated circuits to replace piles of discrete components. They made instruments easier (and faster) to assemble. They took technology developed for our high-end products and adapted it to basic instruments.**

**The result? Instruments that fit today's tight budgets without compromising your need for performance and reliability.**

**You'll find examples of this value-driven design philosophy throughout the Basic Instruments catalog. From instruments to accessories to software, we offer a wide variety of ways to help you get more done with less.**

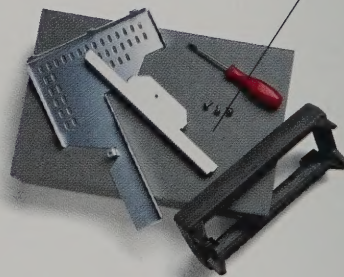
**The engineers at HP will be happy to answer any questions you have about these products, including how they compare with other HP instruments and with competitive instruments.**

## **Here's what happens of cost control.**



### **Benefit from advanced technology without paying for it.**

Our engineers routinely borrow components, algorithms and design ideas developed for HP's top-of-the-line instruments to give you great performance at lower prices. The analog-to-digital converter in the HP 34401A DMM, for instance, is a scaled version of the ADC in our high-performance HP 3458A.

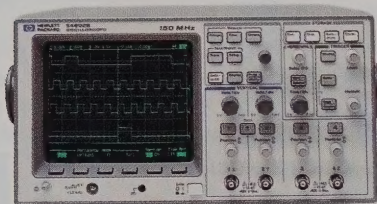


### **You'll spend less because we spend less.**

With a new design that cuts assembly time, incorporates custom ICs to reduce the parts count and simplifies QA testing, we spend less time building the HP 34401A (from 20 minutes down to 6!). These design changes improve performance and reliability, too.

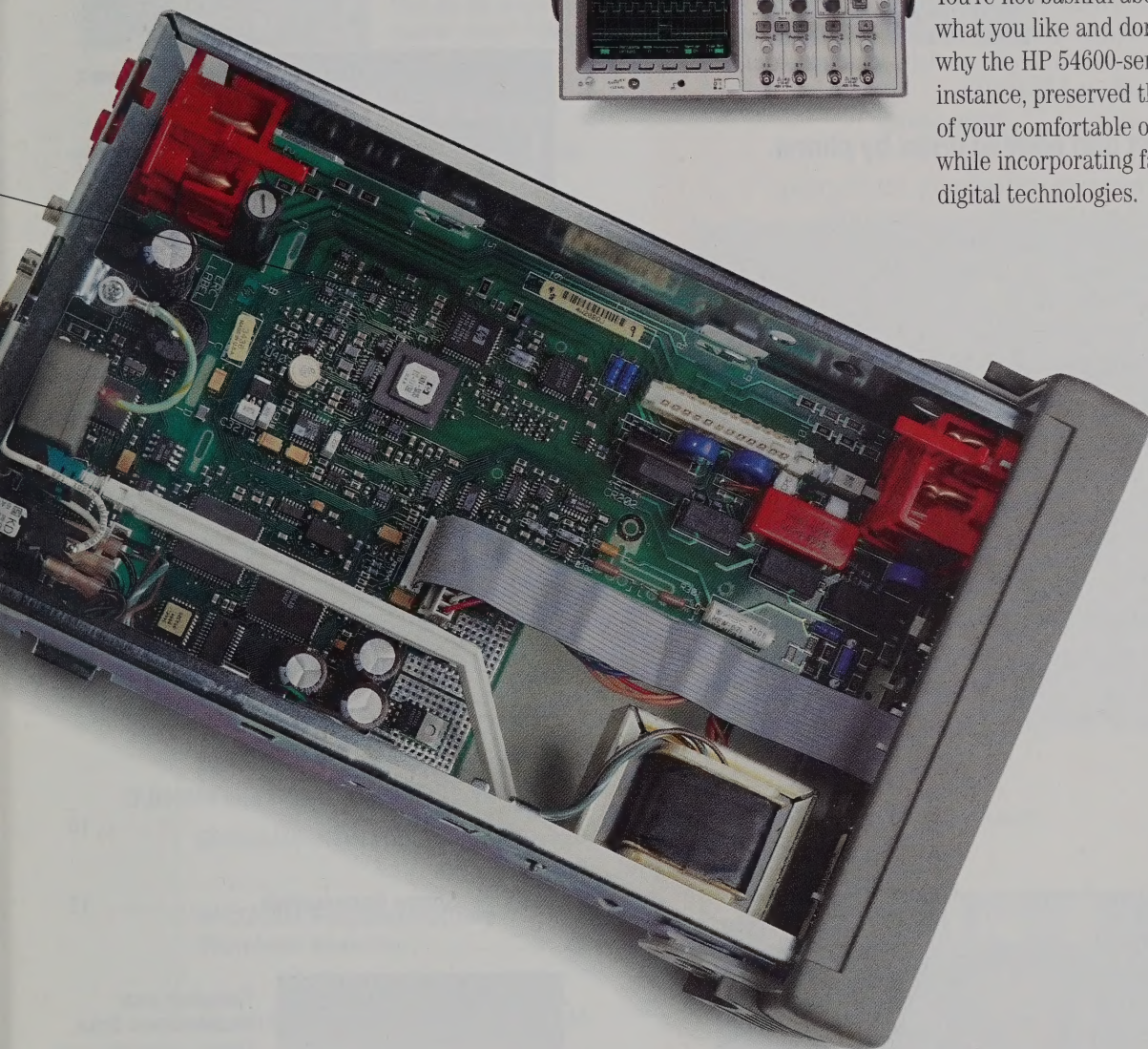


# ened when we put engineers in charge



**You did a nice job of designing these. Thanks.**

You're not bashful about telling us what you like and don't like. That's why the HP 54600-series scopes, for instance, preserved the look and feel of your comfortable old analog scope while incorporating fast, flexible digital technologies.



**If you can change, so can your instruments.**

One of your biggest gripes is getting stuck with equipment that no longer meets your needs. HP Basic Instruments can grow along with you, whether it's a scope module to add new measurements or HP BenchLink software to create new test capabilities.



# From information to instruments, HP DIRECT makes it easy.



## Dependable answers to all your questions.

If you have a quick question or order request, we'll take care of you in a matter of minutes, without wasting your time. Compare one of our products with a competitor's and we'll go over the features and specs to help you decide. If you have a tough application question, one of our engineers will make sure you get the right solution — both technically and financially.



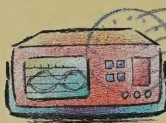
## It's fast and easy to order by phone.

Spend your time on real work, not shopping around for instruments and accessories. HP DIRECT can help with everything from cables to entire test systems.



## Pay whatever way is most convenient.

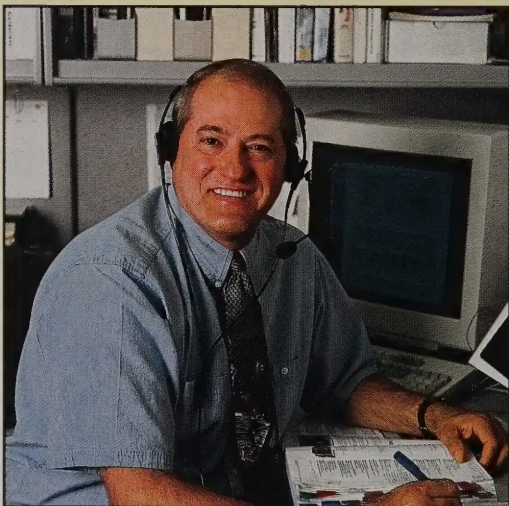
If you have an account with HP, just give us a verbal P.O. number over the phone. (And you can set up an account in minutes if you don't have one yet.) Or pay by VISA, MasterCard or American Express.



## Delivery is always fast and free.

Ground shipping is included in the purchase price. If you need rush delivery, please ask your HP DIRECT sales consultant.

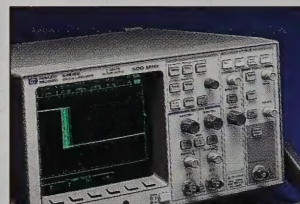
*When you call HP DIRECT you'll talk to engineers such as Roger Bergslien. Roger holds degrees in electrical engineering and industrial management from Purdue, and he brings many years of technical experience to his job of helping customers find ideal solutions to test and measurement applications.*



# The tools for

## Your Guide to Choosing the Right Oscilloscope ..... 4

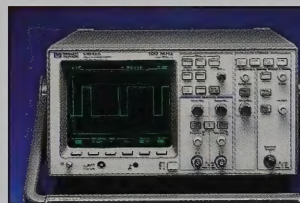
## HP 54600-series Scopes..... 5



**Value that doesn't compromise performance.**  
The HP 54600-series scopes deliver responsive troubleshooting power. Page 5.

## HP 54603B, 54600B and 54602B Basic Scopes..... 6

## HP 54645A 100 MHz Scope with HP MegaZoom ..... 8



**See more than ever before.**  
The new HP 54645A scope gives you resolution and bandwidth at the same time. Page 8.

## HP 54610B, 54615B and 54616B/C 500 MHz Scopes ..... 10

## Scope Accessories ..... 12



**Complete your measurement links.**  
Quality accessories for scopes (page 12) and multimeters (page 26).

## Enhancement Modules for HP 54600-series Scopes ..... 14

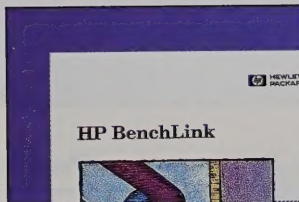
## Mixed-Signal Testing: An Overview..... 15



# your next technical miracle.



**A new way to solve mixed-signal problems.**  
Facing mixed analog and digital systems that are too much for a regular scope? Page 15.



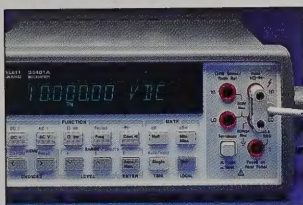
**Do more with test results.**  
HP-IB cards and connectivity software make it easy. Page 36.

**HP 54645D Mixed Signal Oscilloscope . . . . . 16**

**HP 54620A/C Logic Analyzers. . . . . 18**

**HP 1664A Logic Analyzer. . . . . 20**

**HP 34401A Digital Multimeter . . . . . 22**



**Extra precision at standard prices.**  
Get an HP multimeter with more precision and handy test features. Page 22.

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**Multimeter Accessories. . . . . 26**

**HP 33120A Function/Arbitrary Waveform Generator. . . . . 28**

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**Clean power you can count on.**  
Feed your circuits safe power without all the noise. Page 32.

**Power Supplies . . . . . 32**

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## LAB NOTES

Your test and measurement tools need to solve the problems you face on the job, no matter how much your job changes. If you design with microcontrollers, for instance, you need an efficient way to test the 8-bit devices that are replacing the 4-bit chips you used to test with a scope. For an intriguing solution to the 8-bit challenge, please turn to page 15.

Throughout the catalog, look for **Lab Notes**, where the engineers who created these instruments share information about their designs.

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# Balance your budget and get the scope you really need.

| Model           | Repetitive Bandwidth | Sample rate         | Channels          | Special features                            | Price              | Page |
|-----------------|----------------------|---------------------|-------------------|---|--------------------|------|
| HP 54603B       | 60 MHz               | 20 MSa/s            | 2                 | The power of digital at an affordable price | \$1,995.00         | 6    |
| HP 54600B       | 100 MHz              | 20 MSa/s            | 2                 | Ideal for production, field use             | 2,495.00           | 6    |
| HP 54602B       | 150 MHz              | 20 MSa/s            | 4 (2+2)           | Low-cost 4-channel scope                    | 2,995.00           | 6    |
| HP 54610B       | 500 MHz              | 20 MSa/s            | 2                 | High bandwidth at a low price               | 4,295.00           | 10   |
| HP 54615B       | 500 MHz              | 1 GSa/s             | 2                 | Fast sampling with fast updates             | 5,595.00           | 10   |
| HP 54616B       | 500 MHz              | 2 GSa/s             | 2                 | Fast sampling with fast updates             | 6,595.00           | 10   |
| HP 54616C       | 500 MHz              | 2 GSa/s             | 2                 | High resolution color scope                 | 7,595.00           | 10   |
| HP 54645A       | 100 MHz              | 200 MSa/s           | 2                 | 1 M memory on each channel                  | 3,495.00           | 8    |
| HP 54645D       | 100 MHz              | 200 MSa/s           | 2 scope, 16 logic | First true mixed signal scope               | 4,995.00           | 16   |
| HP 54500-series | 500 MHz              | 500 MSa/s – 2 GSa/s | 2/4               | Powerful analysis functions                 | Starts at 9,500.00 | 44   |

## Scopes for general-purpose troubleshooting.

For day-to-day test and measurement, select a scope that's responsive and easy to operate — without compromising precision or quality. See the HP 54600-series scopes starting on page 5. You'll find a wide selection that covers every need, from low-cost models that'll fit the tightest budgets to four-channel lab-quality scopes. And be sure to check out the new HP 54645A, the first scope with HP's exclusive new MegaZoom technology.

## Scopes for mixed-signal testing.

When complex circuits with mixed analog and digital prove to be too much for a standard scope, you're ready for an entirely new approach: a mixed signal oscilloscope. The new HP 54645D MSO (page 15) combines 16 digital timing channels and a great two-channel scope. Now you can attack mixed-mode circuits with 18 channels at once — in an instrument that is as easy to use as the other HP 54600-series scopes.

## Scopes for design characterization.

Need fast, precise measurements with plenty of analysis power? The HP 54615B and HP 54616B/C 500 MHz scopes (page 10) and the HP 54500-series scopes (page 44) offer sampling up to 2 GSa/s. With 1 ns peak detect, single-shot bandwidths up to 500 MHz and color displays on selected models, you'll have the tools to capture and analyze the toughest signals.

**Within budget,  
without compromise.**



# The HP 54600-series scopes: The feel of analog and the power of digital.

- The responsive, intuitive operation that made analog scopes so good for troubleshooting
- The added precision and analysis power of digital processing
- A full range of scopes for field, lab and production line use

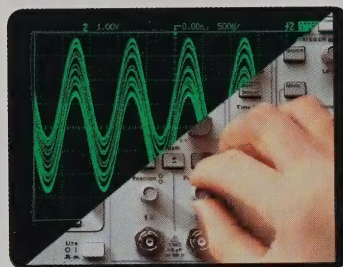
You'll feel right at home with the HP 54600-series digital scopes because they preserve the familiar usability of an analog scope while delivering the power of digital. With three parallel data processors, the HP 54600-series scopes respond instantly to your commands and update the display at rates as high as 3 million points/second (depending on the model).

The new real-time vector display mode on the HP 54600-series makes your signal even easier to see. Slowly changing portions of waveforms appear brighter on the display, while rapidly

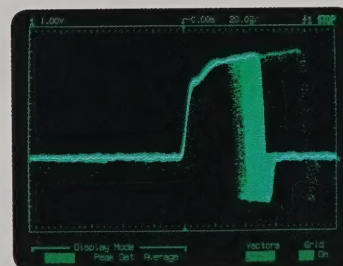
changing portions appear dimmer. No other digital scopes produce waveforms that provide this much visual information or look this close to analog.

Digital processing opens up entirely new possibilities, from improved performance to new measurement functions. Pretriggering lets you look back in time to see what was going on before the trigger event occurred. Autoscale sets voltage, time and trigger parameters to deliver a useful display instantly. Autostore displays the current waveform at full brightness and previous waveforms at half brightness, so it's easy to see signal trends.

Check out pages 6-11, to find which HP 54600-series scope is right for you.



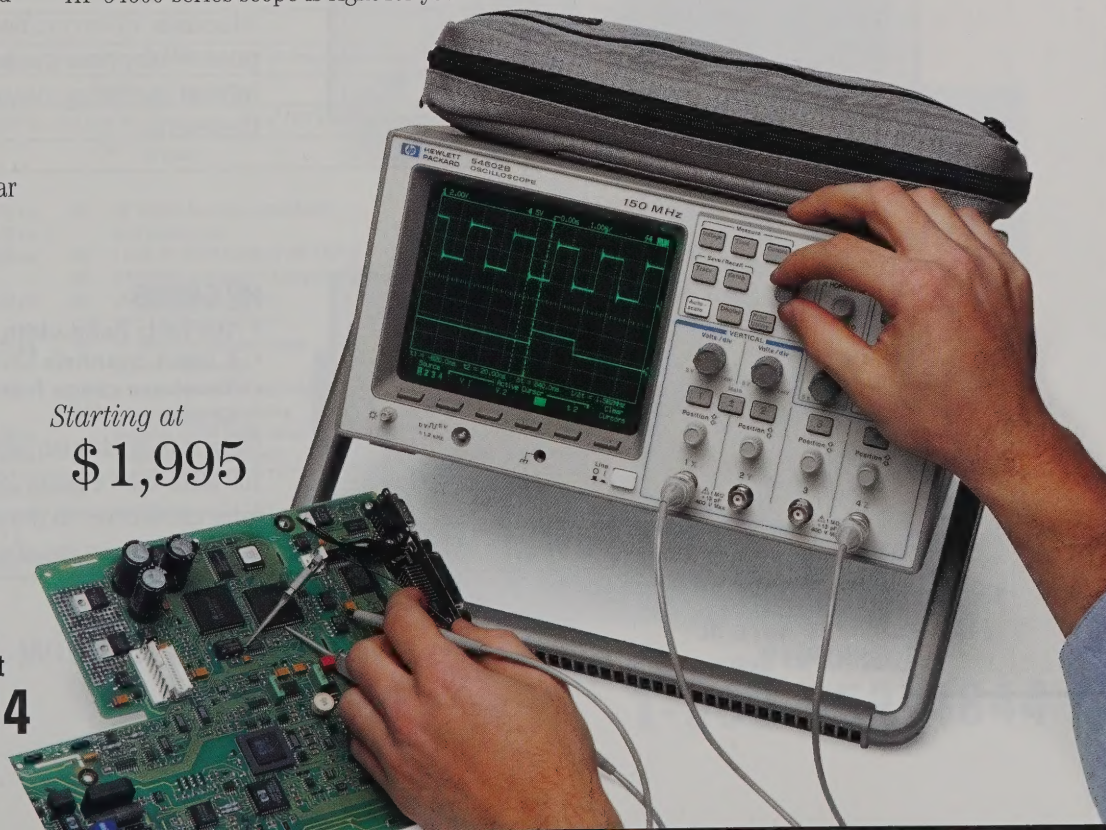
*Turn a control knob and your scope reacts instantly.*



*Autostore shows you signals you can't even see on an analog scope.*

Starting at  
**\$1,995**

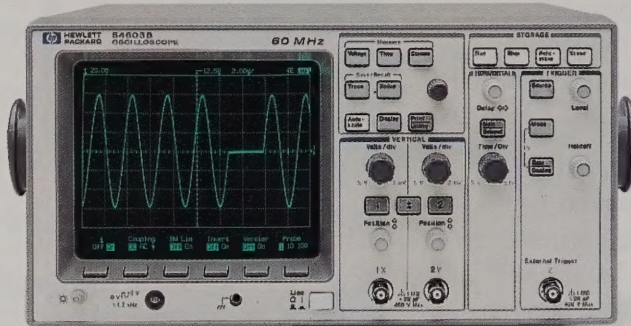
Find the right scope for your application; call HP DIRECT at  
**1-800-452-4844**





# When your budget is limited but your need for quality isn't.

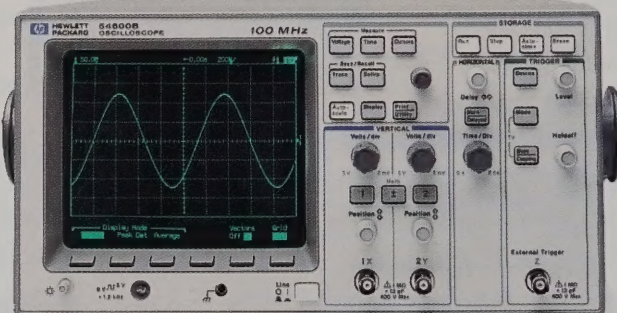
These troubleshooting scopes deliver results you can count on at prices that fit any budget. And be sure to check out the rest of the HP 54600-series scopes on pages 8 – 11.



## HP 54603B

- 60 MHz bandwidth
- 2 input channels
- Timebase range from 5 ns/div to 5 s/div
- \$1,995

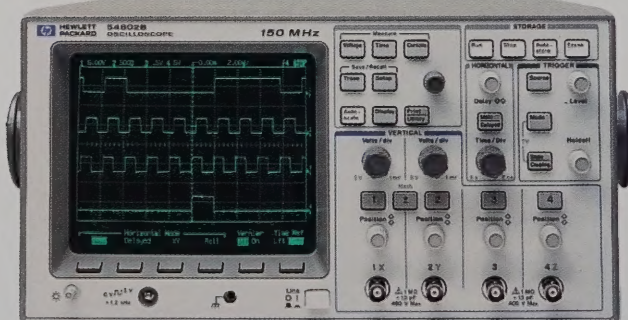
Equipping a lab under tight budget restrictions used to mean giving up quality and capability. Not anymore. The HP 54603B delivers the features and performance you've always wanted. For colleges and universities, this scope is a great way to introduce students to the world of professional test equipment.



## HP 54600B

- 100 MHz bandwidth
- 2 input channels
- Timebase range from 2 ns/div to 5 s/div
- \$2,495

The HP 54600B is ideal for production test, field service and education, where you need solid dependable scopes at a low price. With prices this low, you can afford to equip your staff without sacrificing measurement capability or confidence in the results.



## HP 54602B

- 150 MHz bandwidth
- 4 input channels (2+2)
- Timebase range from 2 ns/div to 5 s/div
- \$2,995

For a high-quality lab scope when your needs go past 100 MHz, take a closer look at the HP 54602B. You get the same capabilities as the other HP 54600-series scopes, with the added advantage of a 150 MHz bandwidth and 1 mV/div sensitivity.



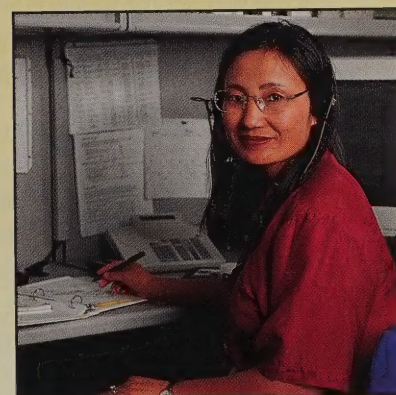
| HP 54600B, HP 54602B and HP 54603B Oscilloscopes  |   |   |  |
|---|---|---|--|
|   | HP 54603B   | HP 54600B                                     | HP 54602B  |
| <b>Bandwidth</b><br>CH 1 & 2<br>ac coupled<br>CH 3 & 4  | dc-60 MHz<br>10 Hz-60 MHz<br>NA                       | dc-100 MHz<br>10 Hz-100 MHz<br>NA             | dc-150 MHz*<br>10 Hz-150 MHz*<br>dc-250 MHz  |
| <b>Number of channels</b>   | 2   | 2   | 4 (2 + 2)  |
| <b>Maximum sample rate</b><br>single shot   | 20 MSa/s  | 20 MSa/s                                      | 20 MSa/s   |
| repetitive  | 10 GSa/s  | 10 GSa/s                                      | 10 GSa/s   |
| <b>Record length (maximum)</b><br>single shot   | 4,000 points<br>2,000 points                          | 4,000 points<br>2,000 points                  | 4,000 points<br>2,000 points   |
| <b>Max. display update rate</b>   | 1,500,000 points/s                                    | 1,500,000 points/s                            | 1,500,000 points/s   |
| <b>Sensitivity</b><br>CH 1 & 2<br>CH 3 & 4  | 2 mV/div to 5 V/div<br>NA                             | 2 mV/div to 5 V/div<br>NA                     | 1 mV/div to 5 V/div<br>0.1 & 0.5 V/div   |
| <b>dc gain accuracy</b>   | ±2%   | ±1.5%   | ±1.5%  |
| <b>Rise time (calculated)</b><br>CH 1 & 2<br>CH 3 & 4   | <5.83 ns<br>NA  | <3.5 ns<br>NA                                 | <2.33 ns<br><1.4 ns  |
| <b>Input impedance</b>  | 1 MΩ, approx. 13 pF                                   | 1 MΩ, approx. 13 pF                           | 1 MΩ, approx. 13 pF  |
| <b>Input coupling</b><br>CH 1 & 2<br>CH 3 & 4   | dc, ac or ground<br>NA                                | dc, ac or ground<br>NA                        | dc, ac or ground<br>dc, ground   |
| <b>Maximum input (dc + peak ac)</b>   | 400 V   | 400 V   | 400 V  |
| <b>Timebase range (main &amp; delayed)</b>  | 5 ns/div to 5 s/div                                   | 2 ns/div to 5 s/div                           | 2 ns/div to 5 s/div  |
| <b>Trigger sources</b>  | CH 1, 2, line, or ext.                                | CH 1, 2, line, or ext.                        | CH 1, 2, 3, 4, or line   |
| <b>Horizontal accuracy</b>  | ±0.01%  | ±0.01%  | ±0.01%   |
| <b>Horizontal resolution</b>  | 100 ps  | 100 ps  | 100 ps   |
| <b>Trigger sensitivity</b><br>dc to 25 MHz<br>dc to max. bandwidth  | 0.35 div or 3.5 mV<br>1 div or 10 mV                  | 0.35 div or 3.5 mV<br>1 div or 10 mV          | 0.35 div or 0.7 mV<br>1 div or 2 mV**  |
| <b>Resolution</b>   | 8 bits  |   |  |
| <b>Power</b>  | Voltage: 100-240 Vac, 48-440 Hz, 300 VA maximum       |   |  |
| <b>Net weight</b>   | Approx. 6.2 kg (14 lbs)                               |   |  |
| <b>Size (excl. handle)</b>  | 172 mm H x 322 mm W x 317 mm D (6.8 x 12.7 x 12.5 in) |   |  |
| <b>Warranty</b>   | 3 years   |   |  |
| <b>Ordering information</b>   |   |   |  |
| HP 54603B Two-channel 60 MHz oscilloscope   | \$1,995.00 ea.  | 101   | HP 10098A Accessory pouch and front panel cover \$51.00 ea.                                    |
| HP 54600B Two-channel 100 MHz oscilloscope  | 2,495.00 ea.  |   |  |
| HP 54602B Four-channel 150 MHz oscilloscope   | 2,995.00 ea.  | 102   | 2 addl. HP 10071A probes (HP 54602B) 158.00 ea.  |
| HP E2657A Measurement/Connectivity kit for HP-IB  | 695.00 ea.  | 103   | HP 54654A Operator's training kit 204.00 ea.   |
|   |   | 104   | 5041-9409 Carrying case 214.00 ea.   |
| HP E2659A Measurement/Connectivity kit for RS-232   | 695.00 ea.  | 1CM   | 5062-7345 Rack mount kit 260.00 ea.  |
|   |   | 106   | HP 34810B BenchLink Scope software (Windows) 295.00 ea.  |
|   |   | (can also be ordered separately as HP 34810B) |  |
| 005 Enhanced TV/video triggering (HP 54602B)  |   | W50   | Additional 2-year warranty, available for HP 54600-series oscilloscopes starting at† 60.00 ea. |
| Trigger on specified video line number  |   |   |  |
| Full bandwidth vertical out on rear panel   | 510.00 ea.  |   |  |
| 090 Delete probes (HP 54600/02/03B)   | -112.00 ea.   |   |  |
| *Maximum bandwidth on CH 1 & 2 is 100 MHz at 1, 2, and 5 mV/div.<br>**HP 54602B, for ranges 1, 2, and 5 mV/div, sensitivity between 25 MHz and 100 MHz on CH 1 & 2 is 2 div or 4 mV.<br>†Call HP DIRECT for more information.<br>Microsoft Windows is a U.S. trademark and MS-DOS is a registered trademark of Microsoft Corporation. |   |   |  |

## Meeting your measurement challenges.

Putting a reliable trace on the display is just the first step in designing a great measurement solution.

To help you get the most from your scope investment, enhancement modules let you expand your measurement, storage and automation capabilities without buying a new scope. See page 14 for details.

To help you work with your measurement results, HP BenchLink Scope makes it easy to move data from your scope to a PC for analysis, documentation and presentation. See page 36 for details.



LADY OAK ARNOLD  
BSEE, Seattle University

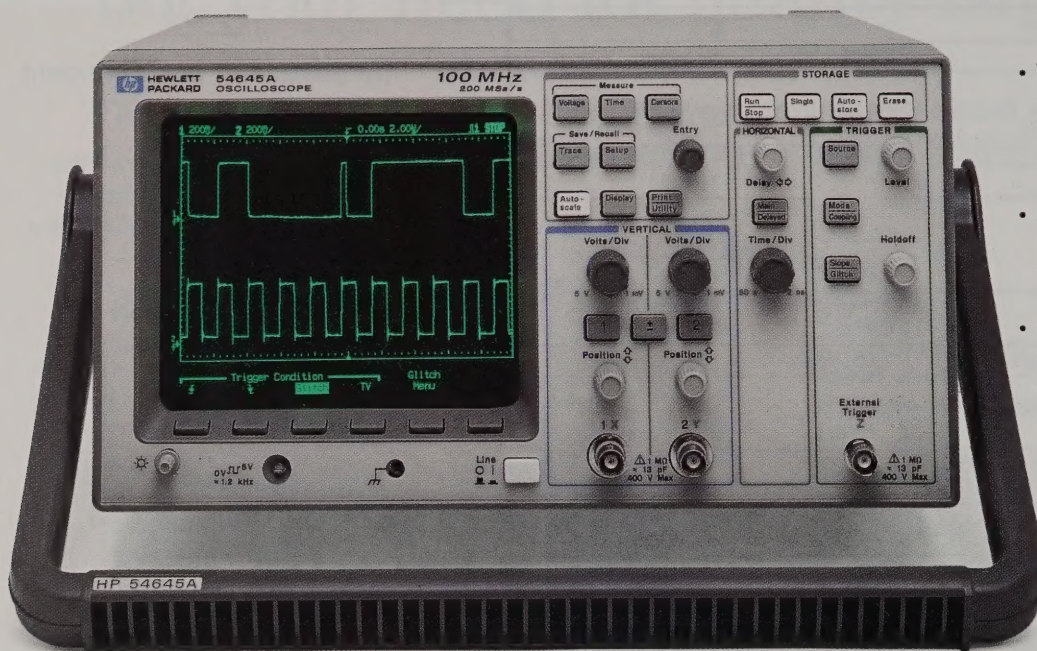
**Within budget, without compromise.**

**For quality and performance  
in a low-priced scope,  
call HP DIRECT at**

**1-800-452-4844**



# The fast, easy way to find the details buried



- Two-channel 100 MHz scope offers 200 MSa/s sampling and 1 M memory behind each channel
- HP's MegaZoom technology allows deep memory capture and a responsive display
- Simple pan-and-zoom makes it easy to scroll through captured data to find those critical details

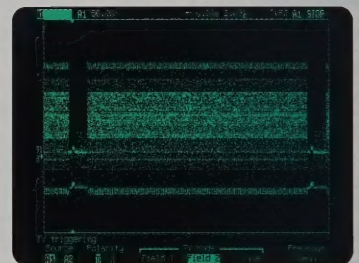
Only  
**\$3,495**

Thanks to the exclusive HP MegaZoom technology, the new HP 54645A 100 MHz two-channel scope gives you longer signal captures, sustained sampling and a display update rate of 3 million points/second. You can think of the HP 54645A as a deep-memory scope without the unpleasant memories — without the expense or the sluggish, difficult operation.

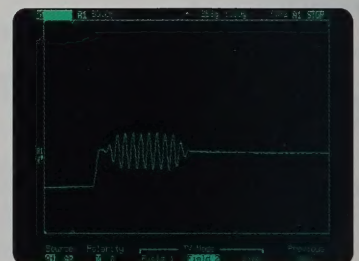
The HP 54645A's pan-and-zoom feature makes it easy to scroll through captured data to find points of interest. This is a great tool for troubleshooting when you don't know enough about the signal to set up triggering or for capturing widely spaced events in a

signal. While you're looking through the captured signal, HP MegaZoom can display the whole waveform. It can easily zoom in to examine events of interest on the screen simultaneously, so you can see the big picture and the important details at the same time.

No matter what kind of circuits you work on, you've probably encountered situations in which the HP 54645A and HP MegaZoom would've delivered better measurements in less time. Catching two events separated by a long time delay, studying signal variations leading up to a trigger condition, measuring high-speed and low-speed signals at the same time — these are just a few of the things HP MegaZoom makes possible.



*With 1 M of memory on each channel, the HP 54645A easily captures an extensive block of data, such as this frame from a video signal.*



*Then to explore the details, you simply turn the time/div knob to zoom in and find what you're looking for. Here's a single line's color burst.*

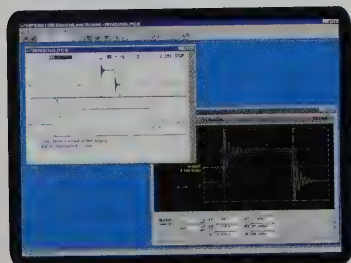


# ed in your most complex signals.

| HP 54645A 100 MHz Oscilloscope                    |                |  |              |
|---|----------------|--|--------------|
| <b>Bandwidth</b>                                  |                | 100 MHz (75 MHz @ < 10 mV/div)   |              |
| Repetitive  |                |  |              |
| Single-shot                                       |                | 20 MHz   |              |
| <b>Number of channels</b>                         |                | 2  |              |
| <b>Maximum sample rate</b>                        |                | 200 MSa/s  |              |
| <b>Memory depth</b>                               |                | 1 M points/channel   |              |
| <b>Peak detect</b>                                |                | 5 ns minimum   |              |
| <b>Sensitivity</b>                                |                | 1 mV/div to 5 V/div  |              |
| <b>dc gain accuracy</b>                           |                | ± 1.5% (1, 2, 5 seq.), ± 3% (vernier)                                      |              |
| <b>Rise time (calculated)</b>                     |                | 3.5 ns   |              |
| <b>Input impedance</b>                            |                | 1 MΩ, 12 pF  |              |
| <b>Input coupling</b>                             |                | dc, ac, ground   |              |
| <b>Maximum input</b>                              |                | 400 V (dc + peak ac)   |              |
| <b>Timebase range (main &amp; delayed)</b>        |                | 2 ns to 50 s/div   |              |
| <b>Trigger sources</b>                            |                | Ch 1, Ch 2, external, and line   |              |
| <b>Glitch triggering</b>                          |                | Minimum width 8 ns, Operators: <, >, or range                              |              |
| <b>Horizontal accuracy</b>                        |                | ±0.01%   |              |
| <b>Horizontal resolution</b>                      |                | 40 ps  |              |
| <b>Maximum display update rate</b>                |                | 3,000,000 points/s   |              |
| <b>Resolution</b>                                 |                | 8 bits   |              |
| <b>Weight</b>                                     |                | 6.4 kg (15 lbs)  |              |
| <b>Size (excl. handle)</b>                        |                | 172 mm H × 322 mm W × 317 mm D (6.8 × 12.7 × 12.5 in)                      |              |
| <b>Power</b>                                      |                | 100-240 Vac, 45-440 Hz, 90 VA  |              |
| <b>Warranty</b>                                   |                | 3 years  |              |
| <b>Ordering information</b>                       |                | <b>Options</b>   |              |
| HP 54645A 100 MHz Two-channel oscilloscope        | \$3,495.00 ea. | 005 Enhanced TV/Video triggering<br>Trigger on specified video line number | \$510.00 ea. |
| HP E2657A Measurement/Connectivity kit for HP-IB  | 695.00 ea.     | 101 HP 10098 Accessory pouch and front panel cover                         | 51.00 ea.    |
| HP E2659A Measurement/Connectivity kit for RS-232 | 695.00 ea.     | 103 HP 54654A Operator's training kit                                      | 204.00 ea.   |
|   |                | 104 5041-9409 Carrying case  | 214.00 ea.   |
|   |                | 1CM 5062-7345 Rack mount kit   | 260.00 ea.   |
|   |                | 106 HP 34810B BenchLink Scope software for Windows                         | 295.00 ea.   |
|   |                | W50 Additional 2-year warranty   | 100.00 ea.   |

Microsoft Windows is a U.S. trademark.

**Within budget,  
without compromise.**

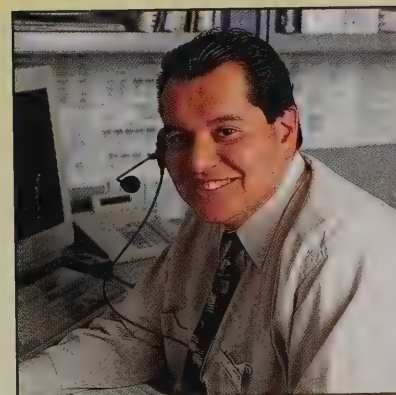


HP BenchLink Scope helps you communicate and analyze measurement results, using the same Windows tools you use for all your documents and presentations.

## Sustaining sample rate with deep memory.

Another key advantage of the HP 54645A's deep memory is *sustained sample rate*.

Let's say you want to analyze a fast digital event (such as an interrupt line being asserted) and look out in time to see when the line was de-asserted. This requires a fast sample rate to examine the signal fidelity of the interrupt edge — and a long time capture to determine how long the interrupt line was asserted. The HP 54645A is one of the few scopes around that can do this — and the only one in this price range. The sales engineers at HP DIRECT are ready to answer any questions you might have.



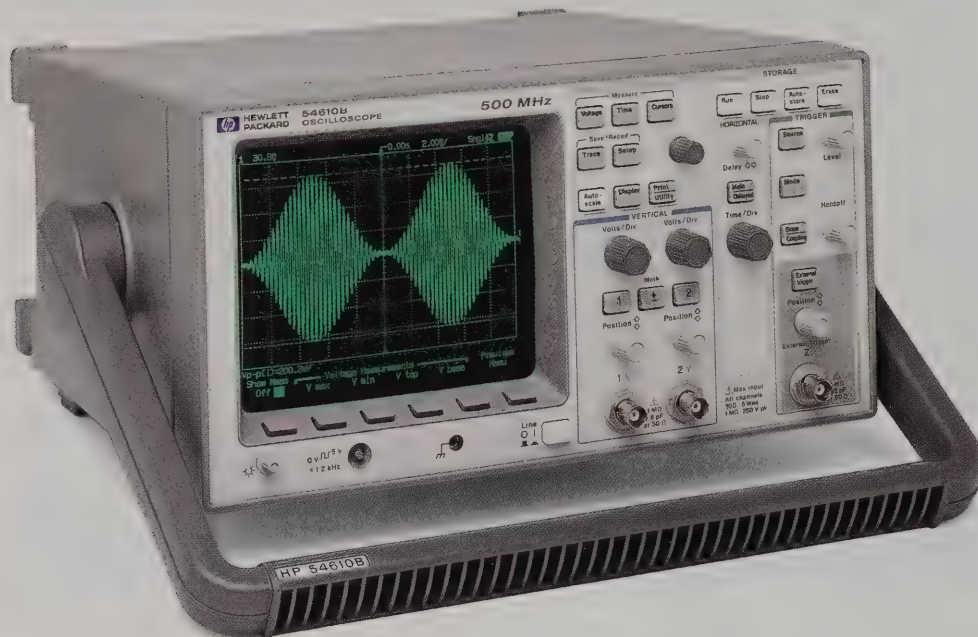
EDGAR MARTINEZ  
BSEE, California State University, Los Angeles

Put HP MegaZoom to work for you;  
call HP DIRECT at

**1-800-452-4844**



# From fast digital to RF, one of these 500 MHz for your application.



- HP 54610B is the industry's lowest-cost 500 MHz scope
- HP 54615B offers 250 MHz single-shot bandwidth with 1 GSa/s
- HP 54616B/C offers 500 MHz single-shot bandwidth and a sample rate of 2GSa/s

Starting at  
**\$4,295**

If you need the bandwidth to handle demanding applications and want the flexibility to choose the one scope that's ideal for your lab, the 500 MHz scopes in the HP 54600-series are sure to offer a solution.

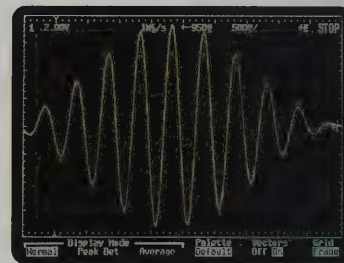
The HP 54610B is the lowest-priced 500 MHz scope on the market, but it doesn't compromise performance or measurement quality. You'll still get  $\pm 0.1\%$  horizontal accuracy and a maximum display update rate of 1.5 million points per second.

The HP 54615B boosts the sampling rate to 1 GSa/s while preserving the intuitive analog feel and instantaneous response of the other HP 54600-series scopes. With horizontal accuracy of  $\pm 0.005\%$  and horizontal resolution

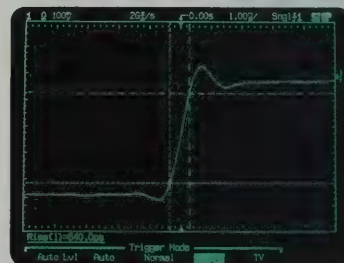
of 20 ps, you'll uncover the details that hide from slower scopes.

For even more signal detail, the HP 54616B doubles the sample rate to 2 GSa/s, delivering a single-shot bandwidth of 500 MHz. The full-color display of the HP 54616C makes all that information easier to see, too.

Speaking of sample rate, many scopes offer good sample rate performance at fast sweep speeds but run into trouble as you slow the sweep down. No matter how slowly you sweep the HP 54615B and 54616B/C, they can still detect glitches as narrow as 1 ns when utilizing peak detect.



*The color display in the HP 54616C helps you compare signals and highlight important details.*



*With single-shot bandwidths as high as 500 MHz, you'll see those important details on high-speed dynamic signals.*



# 500 MHz scopes is the right answer

| HP 54610B, HP 54615B and HP 54616B/C Oscilloscopes  |   |   |  |
|---|---|---|--|
|   | HP 54610B   | HP 54615B   | HP 54616B/C                              |
| <b>Bandwidth</b><br>CH 1 & 2<br>ac coupled  | dc-500 MHz<br>10 Hz-500 MHz                           | dc-500 MHz<br>10 Hz-500 MHz   | dc-500 MHz<br>10 Hz-500 MHz              |
| <b>Single-shot bandwidth</b>  | dc-2 MHz  | 250 MHz   | 500 MHz                                  |
| <b>Number of channels</b>   | 2   | 2   | 2  |
| <b>Maximum sample rate</b><br>single shot<br>repetitive   | 20 MSa/s<br>10 GSa/s                                  | 1 GSa/s<br>10 GSa/s   | 2 GSa/s<br>10 GSa/s                      |
| <b>Record length (maximum)</b><br>single shot   | 4,000 points<br>2,000 points                          | 5,000 points<br>5,000 points  | 5,000 points<br>5,000 points             |
| <b>Max. display update rate</b>   | 1,500,000 points/s                                    | 500,000 points/s  | 500,000 points/s                         |
| <b>Peak detect</b>  | 50 ns   | 1 ns  | 1 ns                                     |
| <b>Sensitivity</b><br>CH 1 & 2  | 2 mV/div to 5 V/div                                   | 2 mV/div to 5 V/div   | 2 mV/div to 5 V/div                      |
| <b>dc gain accuracy</b>   | ±2%   | ±2%   | ±2%                                      |
| <b>Rise time (calculated)</b><br>CH 1 & 2   | <700 ps   | <700 ps   | <700 ps                                  |
| <b>Input impedance</b>  | 1 MΩ, approx. 9 pF<br>or 50 Ω selectable              | 1 MΩ, approx. 9 pF<br>or 50 Ω selectable  | 1 MΩ, approx. 9 pF<br>or 50 Ω selectable |
| <b>Input coupling</b><br>CH 1 & 2   | dc, ac or ground                                      | dc, ac or ground  | dc, ac or ground                         |
| <b>Maximum input (dc + peak ac)</b>   | 250 V or 5 Vrms<br>in 50 Ω mode                       | 250 V or 5 Vrms<br>in 50 Ω mode   | 250 V or 5 Vrms<br>in 50 Ω mode          |
| <b>Timebase range (main &amp; delayed)</b>  | 1 ns/div to 5 s/div                                   | 1 ns/div to 5 s/div   | 1 ns/div to 5 s/div                      |
| <b>Trigger sources</b>  | CH 1, 2, line, or ext.                                | CH 1, 2, line, or ext.  | CH 1, 2, line, or ext.                   |
| <b>Horizontal accuracy</b>  | ±0.01%  | ±0.005%   | ±0.005%                                  |
| <b>Horizontal resolution</b>  | 100 ps  | 20 ps   | 20 ps                                    |
| <b>Trigger sensitivity</b><br>dc to 25 MHz<br>dc to max. bandwidth  | 0.5 div or 2.5 mV*<br>1 div or 5 mV†                  | 0.5 div or 3.5 mV*<br>1 div or 7 mV†  | 0.5 div or 3.5 mV*<br>1 div or 7 mV†     |
| <b>Resolution</b>   | 8 bits  |   |  |
| <b>Power</b>  | Voltage: 100-240 Vac, 48-440 Hz, 300 VA maximum       |   |  |
| <b>Net weight</b>   | Approx. 6.2 kg (14 lbs)                               |   |  |
| <b>Size (excl. handle)</b>  | 172 mm H x 322 mm W x 317 mm D (6.8 x 12.7 x 12.5 in) |   |  |
| <b>Warranty</b>   | 3 years   |   |  |
| <b>Ordering information</b>   |   |   |  |
| HP 54610B Two-channel 500 MHz oscilloscope  | \$4,295.00 ea.  | 090 Delete probes (HP 54610B/15B/16B/C)   | -\$306.00 ea.                            |
| HP 54615B Two-channel 500 MHz oscilloscope  | 5,595.00 ea.  | 101 HP 10098A Accessory pouch and front panel cover   | 51.00 ea.                                |
| HP 54616B Two-channel 500 MHz oscilloscope  | 6,595.00 ea.  | 103 HP 54654A Operator's training kit   | 204.00 ea.                               |
| HP 54616C Two-channel 500 MHz oscilloscope  | 7,595.00 ea.  | 104 5041-9409 Carrying case   | 214.00 ea.                               |
| HP E2657A Measurement/Connectivity kit for HP-IB  | 695.00 ea.  | 1CM 5062-7345 Rack mount kit  | 260.00 ea.                               |
| HP E2659A Measurement/Connectivity kit for RS-232   | 695.00 ea.  | 106 HP 34810B BenchLink Scope software (Windows)<br>(can also be ordered separately as HP 34810B) | 295.00 ea.                               |
| <b>Options</b>  |   | W50 Additional 2-year warranty, available for HP 54600-series oscilloscopes starting at††         | 125.00 ea.                               |
| 005 Enhanced TV/video triggering (HP 54610B/15B/16B/C)<br>Trigger on specified video line number<br>Full bandwidth vertical out on rear panel | 510.00 ea.  |   |  |

\*Trigger sensitivity from dc to 100 MHz.

†Trigger sensitivity from 100 MHz to max. bandwidth.

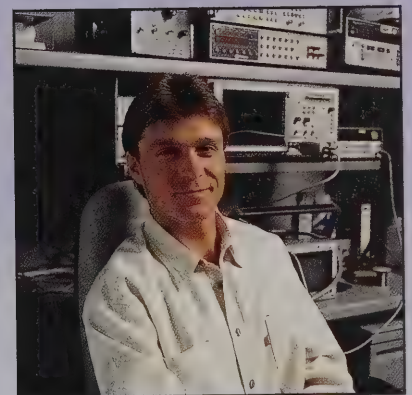
††Call HP DIRECT for more information.

Microsoft Windows is a U.S. trademark and MS-DOS is a registered trademark of Microsoft Corporation.

## LAB NOTES

Figuring out how much bandwidth you need can be a complicated question. Here are three basic guidelines to help you decide:

1. Scope bandwidth should be at least three times as high as the fundamental frequency of the fastest signal you plan to measure.
2. To make amplitude measurements that are not dominated by the scope's frequency response, the -3 dB bandwidth of the scope should be at least 10 times the highest significant frequency in your signals.
3. For timing measurements that approach the accuracy of the scope's timebase, you need a scope that has a rise time at least 20 times faster than the signal you're measuring. For more normal use, a scope that is 3-5 times faster than the signal is acceptable.



TOM SCHMIDT  
R & D Engineer

**Within budget, without compromise.**

What do you need in a 500 MHz scope? Call HP DIRECT at  
**1-800-452-4844**

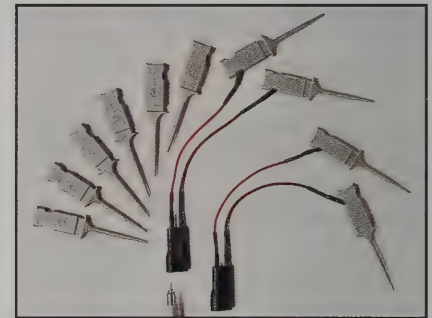
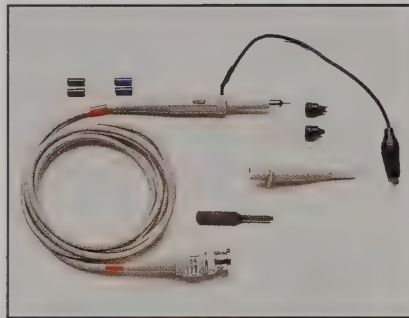


# Quality scope measurements start with quality

**Make sure your measurements get off to a great start with a probe that you can rely on. We offer a wide selection, so you can choose the probe that fits your application and your budget.**

## HP 10070-series passive probes

The HP 10070-series are rugged, general-purpose probes designed for the HP 54600-series scopes. The HP 10072A is an SMT kit for HP 10070-series probes that includes 10 SMT lead grabbers for accessing fine-pitch devices.

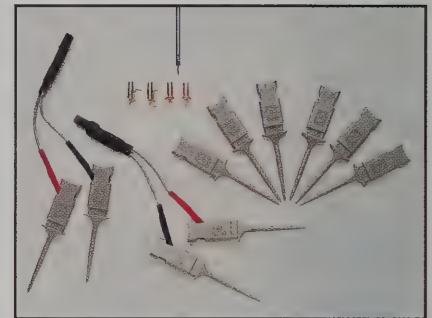
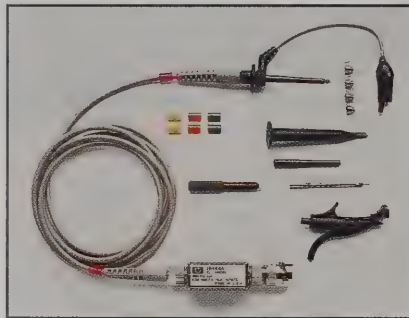


| Product  | Bandwidth | Length | Division Ratio | Circuit Loading       | Compatibility       | Price   |
|--|-----------|--------|----------------|-----------------------|---------------------|---------|
| HP 10070A  | 20 MHz    | 1.5 m  | 1:1            | 1 M $\Omega$ , 70 pF  | HP 54600-series     | \$59.00 |
| HP 10071A  | 150 MHz   | 1.5 m  | 10:1           | 10 M $\Omega$ , 15 pF | HP 54600/01/02/03B  | 79.00   |
| HP 10073A  | 500 MHz   | 1.5 m  | 10:1           | 1 M $\Omega$ , 12 pF  | HP 54610/15/16B     | 153.00  |
| HP 10074A*                                       | 150 MHz   | 1.5 m  | 10:1           | 10 M $\Omega$ , 15 pF | HP 54645A/D         | 84.00   |
| HP 10072A SMT Kit with 10 grabbers (shown above) |           |        |                |                       | 10070-series probes | 66.00   |

\*includes probe sense pin

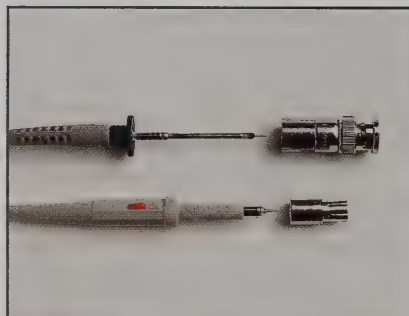
## HP 10400-series passive probes

The HP 10400-series offer a wide range of probes that feature superior reliability and electrical performance in a miniature package. The narrow, sharp probe tip is good for surface mount devices. The HP 10450A is an SMT kit for HP 10400-series probes that includes 10 SMT lead grabbers for accessing fine-pitch devices. Also includes four mini-probe sockets.

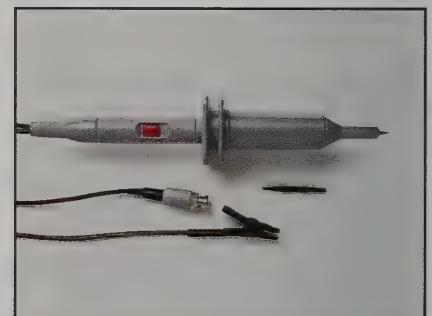


| Product  | Bandwidth | Length | Division Ratio | Circuit Loading       | Compatibility       | Price    |
|--|-----------|--------|----------------|-----------------------|---------------------|----------|
| HP 10441A  | 500 MHz   | 2 m    | 10:1           | 1 M $\Omega$ , 9 pF   | HP 54610/15/16B     | \$229.00 |
| HP 10444A  | 500 MHz   | 1.6 m  | 10:1           | 1 M $\Omega$ , 9 pF   | HP 54610/15/16B     | 229.00   |
| HP 10431A  | 500 MHz   | 1 m    | 10:1           | 1 M $\Omega$ , 6.5 pF | HP 54610/15/16B     | 229.00   |
| HP 10450A SMT Kit with 10 grabbers (shown above) |           |        |                |                       | 10400-series probes | 82.00    |

**Within budget,  
without compromise.**



HP 1250-1454 BNC probe tip adapter  
for 10400-series probes.....\$13.00  
HP 5081-7705 BNC probe tip adapter  
for HP 10070-series probes.....\$27.00

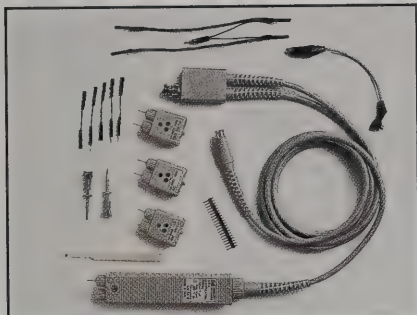


**HP 1137A high-voltage probe.....\$209.00**

- Safely measure up to 5 kVdc, 5 kVac up to 250 kHz, and 2.5 kVac from 250 kHz to 1 MHz
- Compatible with any scope that has 1 M $\Omega$  input resistance and input capacitance between 6 and 50 pF

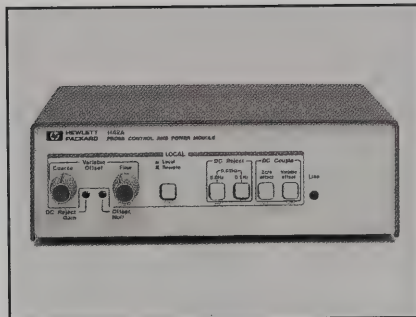


# Quality accessories.



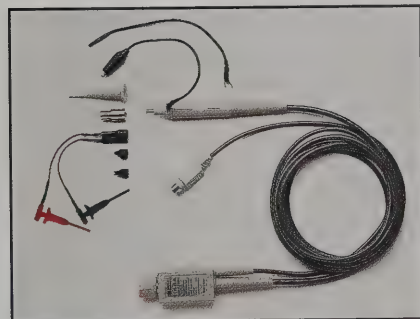
**HP 1141A differential probe .....\$1,710.00**

- 3000:1 common mode rejection ratio and 200 MHz bandwidth, 10X/100X
- Compatible with any scope with 50  $\Omega$  inputs (The HP 1141A probe must be operated with the HP 1142A power module.)



**HP 1142A probe control and power module .....\$835.00**

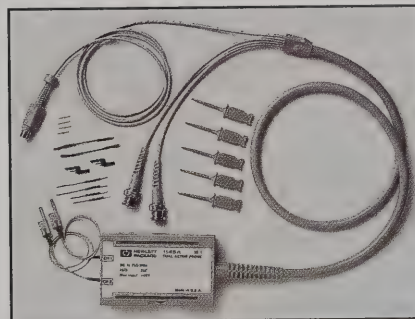
- Used with HP 1141A, 1144A and 1145A.
- (The HP 1144A/1145A probe can be powered directly from the HP 54500-series and HP 54615/16B scopes; with all other scopes, you need the HP 1142A power module.)



**HP 1144A 800 MHz active probe .....\$715.00**

- 1 M $\Omega$  input resistance and 2.0 pF input capacitance
- 10:1 attenuation

\*See above HP 1142A probe control and power module



**HP 1145A 750 MHz active probe for SMD .....\$1,225.00**

- Small-geometry probe for surface-mount devices
- 1 M $\Omega$  & 2.0 pF inputs — minimal loading at both high and low frequencies

\*See above HP 1142A probe control and power module



**HP 1146A Oscilloscope Current Probe .....\$399.00**

- 100 mA to 100 A rms, dc to 100 kHz
- Compatible with any scope with 1 M $\Omega$  input



**HP 5041-9409 carrying case .....\$310.00**

- Safe, convenient way to ship or store your HP 54600-series scope
- Room for an add-on module or other scope accessories



**HP 1183A testmobile .....\$495.00**

- Locking mechanism designed specifically for the HP 54600-series scopes and HP 54620A/C logic analyzers
- Makes sharing your scope easy

## Other accessories

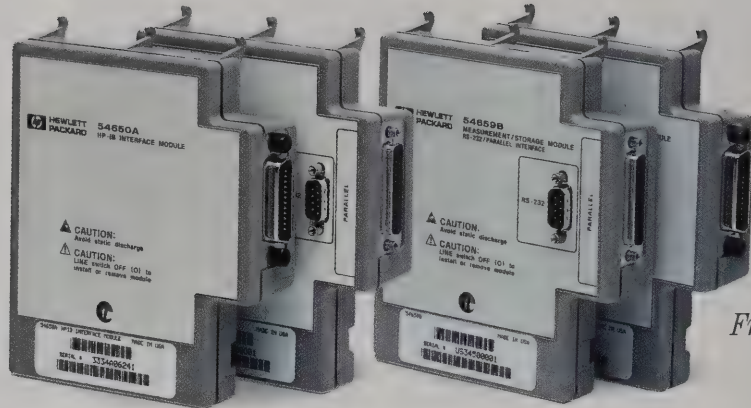
- HP 10110B dual banana to BNC(m) adapter .....\$27.00
- HP 1251-2277 dual banana to BNC(f) adapter .....19.50
- HP 10100C 50  $\Omega$  feedthrough .....63.00
- HP 11094B 75  $\Omega$  feedthrough .....37.00
- HP 34397A dc and ac inverter .....160.00

**For a complete range of scope accessories, call HP DIRECT at  
1-800-452-4844**



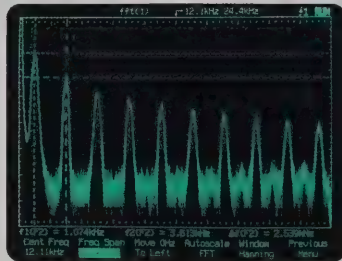
# Boost scope performance without breaking your budget.

- Measurement/storage modules add FFT and other powerful measurements
- Interface modules provide HP-IB, RS-232/parallel connections
- Measurement/connectivity kits provide everything you need to connect a scope to your PC



From \$295  
to \$695

Transforming your HP 54600-series scope into a versatile test and measurement station is now as simple as popping on a module. It's easy to add direct hard copy, PC connectivity, remote control, and advanced measurement capabilities such as fast Fourier transforms (FFT) and benchtop automation. You'll solve problems and boost productivity in ways that just aren't possible with ordinary scopes.



*Turn on FFT, check in the frequency domain, and track down the cause of circuit failures.*

domain (such as harmonic distortion) are much easier to analyze in the frequency domain.

This module also provides many other features to make your work easier, including unattended signal monitoring and failure detection, measurements of channel-to-channel delay and phase, user-definable voltage levels

for timing measurements, and extended math functions and cursor readouts.

If all you need is an interface, add HP-IB with the HP 54650A or both RS-232 and parallel connections with the HP 54652B.

To simplify interfacing with a PC, our measurement/connectivity kits HP E2657A (HP-IB) or HP E2659A (RS-232) give you the hardware and software you need to connect your scope: a measurement/storage module, an HP-IB or RS-232 cable and HP BenchLink Scope software. You'll increase your scope's capability and add the easiest way possible to move scope images and data to your PC.

For high-performance tools usually found only in much more expensive scopes — including the FFT to view signals in the frequency domain — add the HP 54657A (HP-IB) or HP 54659B (RS-232 and parallel) measurement/storage module. Common problems that are difficult or impossible to see in the time

| HP 54600-series Scope Interface and Enhancement Modules |  |              |
|---|--|--------------|
| Ordering information                                    |  |              |
| Product*  | Description                                  | Price        |
| HP 54650A   | HP-IB Interface module                       | \$295.00 ea. |
| HP 54652B   | RS-232 & Parallel Interface module           | 295.00 ea.   |
| HP 54657A   | HP-IB Measurement/Storage module             | 495.00 ea.   |
| HP 54659B   | RS-232 & Parallel Measurement/Storage module | 495.00 ea.   |
| HP E2657A   | Measurement/Connectivity kit for HP-IB       | 695.00 ea.   |
| HP E2659A   | Measurement/Connectivity kit for RS-232      | 695.00 ea.   |
| HP 34810B   | BenchLink Scope software for Windows         | 295.00 ea.   |

\*Modules with product numbers ending in "A" are compatible with HP 54600A-series and 54600B-series scopes. Modules ending in "B" are compatible with the HP 54600B-series only. (Note that the HP 54620A/C logic analyzers can use any of these modules, but it uses the modules for I/O only.)  
Microsoft Windows is a U.S. trademark and MS-DOS is a registered trademark of Microsoft Corporation.  
See page 41 for HP-IB and RS-232 cable needs.



# Succeeding in a mixed-signal world.

When you're creating next-generation products, the last thing you need to worry about is how you're going to test those innovative new designs. Apply the latest test tools from HP, and you won't have to worry. We'll be there to meet your test needs, no matter where markets and technologies take you.

## Design problems are outgrowing the answers a scope can provide.

You used to be able to get by with a scope for testing mixed-signal circuits, but the growth of 8- and 16-bit microcontrollers has made testing a lot more complicated. Now the limitations of your scope start to outweigh the benefits of its familiarity. Instead of saving you time, the scope is now costing you time because it doesn't have enough channels to measure all these signals or enough triggering capability to isolate important events. You're forced to measure in a piecemeal fashion, with only a few channels when you need a dozen or more.

## A new solution for the new challenge of mixed-signal testing.

The ideal solution would combine the familiar usability of your scope with the measurement capability you need for those increasingly complex mixed-signal circuits. That's a great way to sum up the new HP 54645D mixed signal oscilloscope. It seamlessly integrates two 100 MHz scope channels with 16 logic channels for synchronized, simultaneous measurements of both analog and digital signals.

In other words, on top of being a great scope for your everyday measurement needs, the HP 54645D is an innovative new solution to those complex mixed-signal tests that are beyond the reach of your current scope.

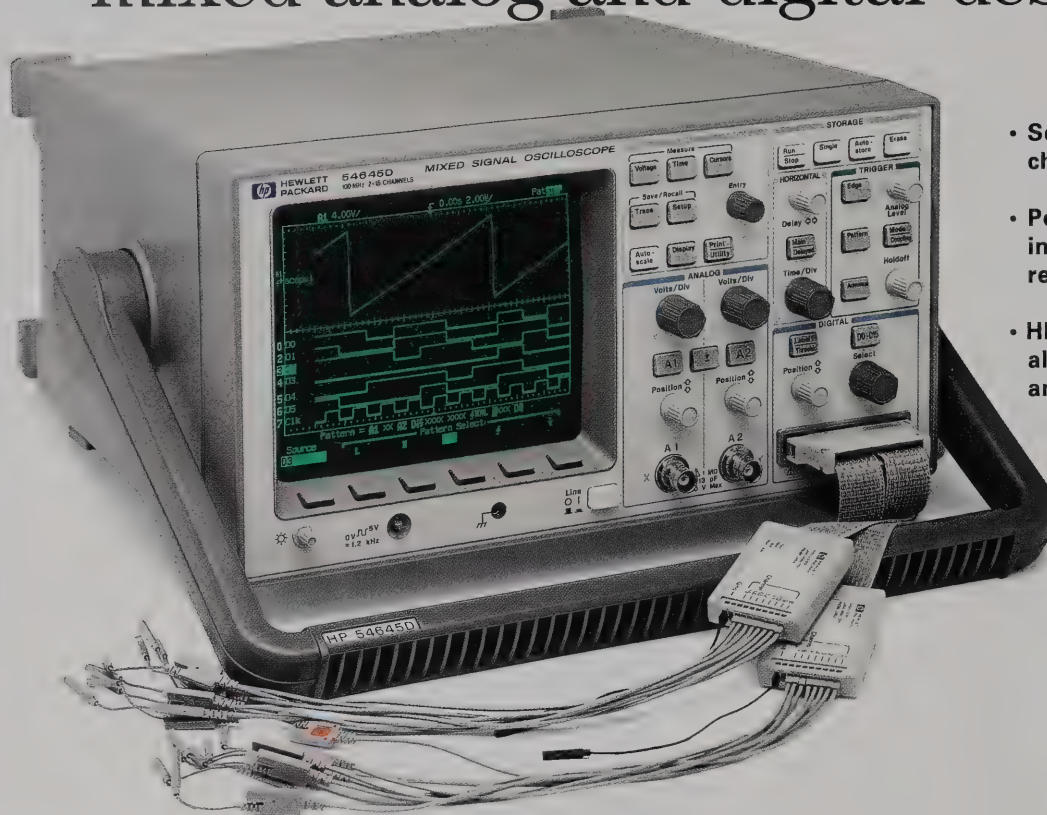
Turn the page to see how this new scope can help you meet a variety of current and emerging measurement needs.

When you need a better way to test mixed-signal circuits, call  
HP DIRECT at

**1-800-452-4844**



# The new HP 54645D mixed signal scope: mixed analog and digital designs.



- Seamlessly integrates 2 scope channels and 16 logic channels
- Powerful triggering isolates important events and signal relationships
- HP's MegaZoom technology allows deep memory capture and a responsive display

Only  
**\$4,995**

The new HP 54645D mixed signal oscilloscope combines the detailed signal analysis of a scope with the multichannel timing measurements of a logic analyzer and the benefits of deep memory. Plus, it offers the exclusive new HP MegaZoom technology.

With the mixed-signal display and powerful triggering, you can capture and analyze the signals and relationships that matter most. No more guesswork and no more poking around a few channels at a time.

The design behind HP MegaZoom solves the problems of sluggish response

and complex operation commonly associated with deep memory. So not only will you get a great two-channel scope, you'll have the capture and analysis power of deep memory on all 18 channels.

With all this power, the HP 54645D can easily conquer problems that a normal scope can't

begin to address. Such as correlating a serial data sequence with variations in an analog signal or triggering on a mix of digital bus states and analog signal details. The combination of scope channels, logic channels and HP MegaZoom deep memory provides totally new ways to solve digital and mixed-signal problems.



*View circuit operation in ways you've never been able to measure before.*



# The fast, efficient way to test those

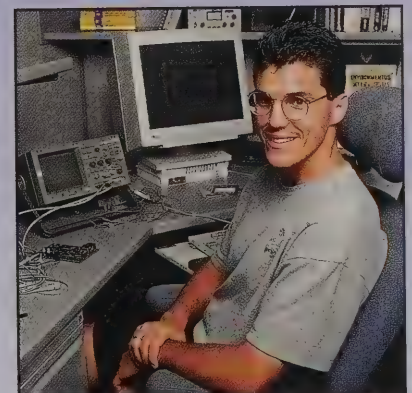
| HP 54645D Mixed Signal Oscilloscope  |   |  |
|--|---|--|
| Scope channels   |   |  |
| Bandwidth  | 100 MHz (75 MHz @ < 10 mV/div)  |  |
| Number of channels   | 2   |  |
| Maximum sample rate  | 200 MSa/s   |  |
| Memory depth   | 1 M points/channel  |  |
| Peak detect  | 5 ns minimum  |  |
| Input impedance  | 1 MΩ, 12 pF   |  |
| Maximum input  | 400 V (dc + peak ac)  |  |
| Range  | 1 mV/div to 5 V/div   |  |
| Resolution   | 8 bits  |  |
| Coupling   | ac, dc, gnd   |  |
| Logic channels   |   |  |
| Number of channels   | 16 (two 8-channel pods)   |  |
| Maximum sample rate  | 400 MSa/s one pod only; 200 MSa/s both pods active  |  |
| Memory depth   | 2 M points/channel one pod only; 1 M both pods active   |  |
| Input R & C  | 100 kΩ, 8 pF  |  |
| Input level  | ± 40 V max, 500 mVp-p min   |  |
| Threshold range  | ± 6.0 volts in 50 mV increments   |  |
| Predefined thresholds  | TTL (1.4 V), CMOS (2.5 V), ECL (-1.3 V)   |  |
| Peak detect  | 5 ns minimum  |  |
| Timebase   |   |  |
| Range (main & delayed)   | 5 ns to 50 s/div  |  |
| Accuracy (nonvernier ranges)   |   |  |
| Scope, same channel  | ± 0.01% of reading ± 0.2% of screen width ± 40 ps   |  |
| Scope, channel to channel  | ± 0.01% of reading ± 0.2% of screen width<br>± 80 ps  |  |
| Logic, same channel  | ± 0.01% of reading ± 0.2% of screen width<br>± (1 logic sample period, 2.5 or 5 ns) ± chan-to-chan skew   |  |
| Logic, channel to channel  | ± 0.01% of reading ± 0.2% of screen width<br>± (1 logic sample period, 2.5 or 5 ns) ± chan-to-chan skew   |  |
| Triggering   |   |  |
| Sources  | All channels and line   |  |
| Glitch triggering  | Minimum width 8 ns Operators: <, >, or range  |  |
| Logic trigger modes  | Edge, pattern, glitch, advanced pattern, TV<br>Advanced Pattern Operators: And, Or, Then, Entered, Exited,<br>Duration time, Duration >, Duration < |  |
| Power  | 100-240 Vac, 45-440 Hz, 90 VA   |  |
| Weight   | 6.4 kg (15 lbs)   |  |
| Size (excl. handle)  | 172 mm H x 322 mm W x 317 mm D (6.8 x 12.7 x 12.5 in)   |  |
| Warranty   | 3 years   |  |
| Ordering information   |   | Options  |
| HP 54645D Mixed signal oscilloscope  | \$4,995.00 ea.  | 101 HP 10098 Accessory pouch and front panel cover \$51.00 ea. |
| Includes two scope probes (HP 10074), one logic cable (HP 54620-61601), power cord, and manual |   | 103 Operator's training kit 204.00 ea.                         |
| HP 54650A HP-IB Interface module   | 295.00 ea.  | 104 5041-9409 Carrying case 214.00 ea.                         |
| HP 54652B RS-232/Parallel Interface module   | 295.00 ea.  | 1CM 5062-7345 Rack mount kit 260.00 ea.                        |
| HP 54657A HP-IB Measurement/Storage module   | 495.00 ea.  | 106 HP 34810B BenchLink Scope software for Windows 295.00 ea.  |
| HP 54659B RS-232/Parallel Measurement/Storage module   | 495.00 ea.  | W50 Additional 2-year warranty 125.00 ea.                      |
| Microsoft Windows is a U.S. trademark.   |   |  |

Microsoft Windows is a U.S. trademark.

## LAB NOTES

Other deep-memory scopes force you to select memory depth because they must choose between fast display updates or deep memory. HP MegaZoom combines deep memory and a fast, responsive display. You don't have to select a special mode to run deep memory, either. Just press the Stop key to pan-and-zoom through captured data.

HP MegaZoom is made possible by multiple processors, each optimized to specific tasks in the acquisition, storage and display of your waveforms.



STU HALL  
R & D Engineer

Ask for a demo CD to see the HP 54645D in action; call HP DIRECT at  
**1-800-452-4844**



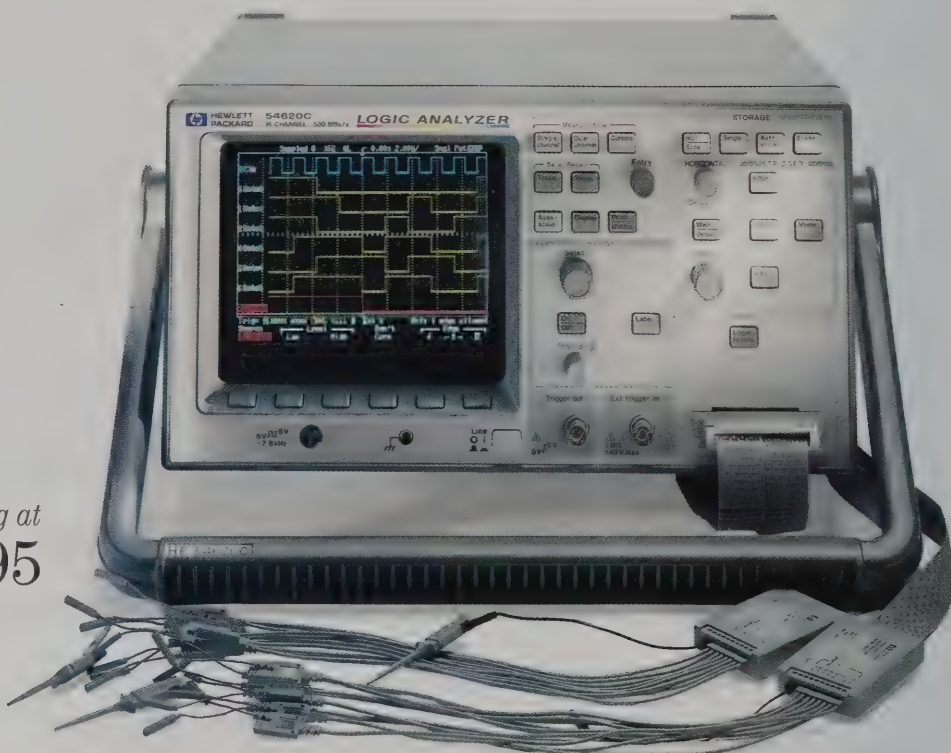
# The perfect partner for that scope you're

A good scope can do some pretty amazing things when it comes to testing digital and mixed analog-digital circuits. However, even a four-channel scope can use some help with the

complex timing and triggering problems you face today. That's the idea behind this new class of logic analyzers — working with your scope to create a total measurement solution.

- 16 channels of logic analysis at 500 MSa/s maximum sampling rate
- A perfect companion for your scope — together they can provide all the signal measurements you need
- Simple, intuitive operation feels like a scope because it's built on a scope platform

Starting at  
**\$2,995**



Think how easy it would be to troubleshoot complicated digital and mixed-signal circuits if your scope had an additional 16 channels of powerful timing analysis and the ability to trigger on edges, patterns, duration times and sequences.

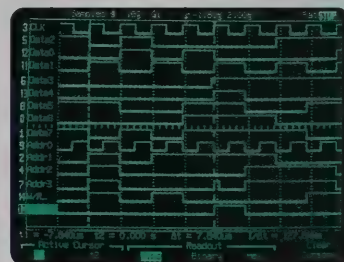
That's the idea behind the HP 54620A/C, which represent a whole new way of looking at logic analysis. They combine the essentials of timing analysis with the intuitive feel of a scope.

The 500 MSa/s sampling rate gives you the power to catch the nastiest glitches, and one-button Autoscale shows your results immediately. The color display in the HP 54620C makes

analysis even easier. Add automatic measurements of frequency, period, duty cycle, width, delay and hold time, and you're ready for any problem your digital circuits try to throw at you.



*Catch unstable and transient events, just as you would on your scope.*



*You've never done this on a logic analyzer — all active signals on the display, scaled for easy viewing, all with just one press of the Autoscale button.*



# using to test mixed-signal circuits.

| HP 54620A/C Logic Analyzer   |   |                                  |  |
|--|---|----------------------------------|--|
| Timing channels<br>Input R & C<br>Maximum input  | 16 numbered 0–15 (all simultaneous)<br>Approximately 100 k $\Omega$ and 8 pF<br>$\pm$ 40 V  | Minimum input<br>Threshold range | 500 mVp-p about threshold<br>$\pm$ 6.0 V               |
| Timebase range<br>(main and delayed)   | 5 ns/div to 1 s/div   |                                  |  |
| Timebase accuracy  | 0.01% of reading  |                                  |  |
| Timebase cursor accuracy<br>Single channel<br>Dual channel   | $\pm$ (sample period + 0.01% of reading + 0.2% of screen width)<br>$\pm$ (sample period + 0.01% of reading + ch-ch skew + 0.2% of screen width)   |                                  |  |
| Maximum sample rate  | 500 MSa/s   |                                  |  |
| Record length  | 2 k for sample period $\geq$ 8 ns (sweep speeds of 1 $\mu$ s/div to 1 s/div), 8 k for all other sweep speeds, and when auto glitch is disabled    |                                  |  |
| Glitch detect  | Automatically activated when sampling period is slowed to be $>$ 4 ns (1 $\mu$ s/div and slower). Minimum detectable glitch: 3.5 ns               |                                  |  |
| Triggering sources   | All channels and external   |                                  |  |
| Auto/normal operation<br>Autotrigger<br>Normal   | Free-running display if trigger not found<br>Analyzer will wait indefinitely for trigger  |                                  |  |
| Modes  | Edge, pattern, advanced (2 pattern and edge terms). Advanced operators: And, Or, Then, Entered, Exited, Duration ( $<$ $>$ ) time, Occurs N times |                                  |  |
| Setup functions  | Autoscale, 16 saved setups, 2 trace memories, channel labeler (with 75 preset and user-defined labels)  |                                  |  |
| Interface  | Compatible with HP 54650A, HP 54651A, and HP 54652B interface modules, and HP 34810B BenchLink Scope software                                     |                                  |  |
| Net weight   | 6.8 kg (15 lbs)   |                                  |  |
| Size   | 172.7 mm H x 322.6 mm W x 317.5 mm D (6.8 x 12.7 x 12.5 in)   |                                  |  |
| Warranty   | 3 years   |                                  |  |
| Ordering information   |   |                                  |  |
| HP 54620A  | 16-Channel logic analyzer   | \$2,995.00 ea.                   | Opt. 103 54654A Operator's training kit \$204.00 ea.   |
| HP 54620C  | 16-Channel logic analyzer   | 3,995.00 ea.                     | HP 34397A dc-to-ac Inverter 160.00 ea.                 |
| HP 54615T  | (HP 54615B, HP 54620A)  | 7,995.00 ea.                     | Opt. 104 5041-9409 Carrying case 214.00 ea.            |
| HP 54616TC   | (HP 54616C, HP 54620C)  | 10,995.00 ea.                    | Opt. 106 HP 34810B BenchLink Scope software 295.00 ea. |
| Opt. 101   | Accessory pouch and front panel cover   | 51.00 ea.                        | Opt. 1CM 5062-7345 Rack mount kit 260.00 ea.           |
| Did you know you can use HP BenchLink Scope to connect the HP 54620A to a PC? See page 36 for details. |   |                                  |  |

Did you know you can use HP BenchLink Scope to connect the HP 54620A to a PC? See page 36 for details.

## A great scope and a great logic analyzer — at a great price.

Now it's easier than ever to add a precision 500 MHz scope and the innovative HP 54620A/C logic analyzer to your test bench. We've bundled these analyzers with the HP 54615/16

scopes at reduced prices. The HP 54615T bundle offers the HP 54615B scope and the HP 54620A logic analyzer. The HP 54616TC bundle brings full color to your measurements, with the HP 54616C color scope and the HP 54620C color logic analyzer.

**Within budget,  
without compromise.**

## Flexible logic analysis.

As the world's leading supplier of logic analyzers, we have a solution to fit every budget and every circuit. If you need both timing and state analysis, the HP 1660-series offers 32 to 136 channels (please turn to the next page).

If timing analysis is all you need and you'd like both logic and scope measurements, we have several options to offer. If you're happy with your current scope, the HP 54620A/C logic analyzers shown here will add the timing analysis you need. If you'd like to add a great scope and one of these logic analyzers, you can get them at a reduced price with the HP 54615T/16TC bundles on this page. And for both logic and scope measurements in a single instrument, check out the HP 54645D mixed signal oscilloscope on page 16.



**SAM REUSSER**  
BSEE, University of Colorado

For a whole new way to look  
at logic, call HP DIRECT at  
**1-800-452-4844**



# The measurement power to stay on schedule



- **32 channels of state analysis/34 channels of timing analysis at clock rates up to 500 MHz**
- **Flexible operation: front panel, mouse or PC-style keyboard**
- **Powerful triggering — and graphical trigger setup makes it easy to use**

Only  
\$4,600

Whether you need to troubleshoot hardware, verify bus operation or debug software, the HP 1664A logic analyzer offers comprehensive state and timing analysis and the advanced triggering you need for testing complex digital systems quickly and efficiently.

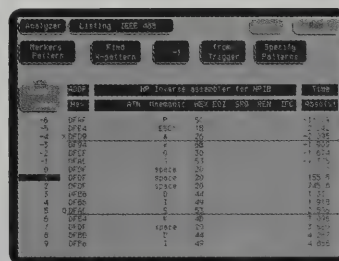
Having both state and timing analysis lets you see problems from more than one angle as you investigate signal timing, data flow or code execution. Chart mode converts streams of data into visual information, and compare mode makes it easy to check prototypes against a verified master. And if you

need further analysis, simply transfer data and graphics to your PC.

Choose conventional timing mode for resolution down to 2 ns or transitional timing mode to analyze bursts of data as far as 34.4 seconds apart and up to 9.7 hours long. Transitional timing offers 8 ns resolution

at 125 MHz on all channels or 4 ns on half channels, and the glitch timing mode detects intermittent signals as brief as 3.5 ns.

When problems are buried under layers of logic, you'll have 12 sequence levels for state triggering and 10 levels of timing triggering to capture complex event series.



*Tracing software execution and untangling bus communication are just two uses of the powerful state analysis tools.*



# ... at a price that'll stay on budget.

|                                    |                |   |              |
|------------------------------------|----------------|---|--------------|
| HP 1664A Logic Analyzer            |                |   |              |
| State and timing channels          |                | 32 state, 34 timing   |              |
| Memory depth/channel               |                | 4 K per channel, 8 K in half-channel mode   |              |
| Timing analysis                    |                |   |              |
| Conventional mode                  |                | 250 MHz all channels<br>500 MHz half channels   |              |
| Transitional mode                  |                | 125 MHz all channels<br>250 MHz half channels   |              |
| Glitch mode                        |                | 125 MHz half channels   |              |
| Sample period accuracy             |                | ±0.01% of sample period   |              |
| Channel-to-channel skew            |                | 2 ns typical, 3 ns maximum  |              |
| Minimum detectable glitch          |                | 3.5 ns  |              |
| State analysis                     |                |   |              |
| Maximum speed <sup>1</sup>         |                | 50 MHz  |              |
| State clocks/qualifiers            |                | 2   |              |
| Setup/hold time <sup>2</sup>       |                | 0/3.5 ns through 3.5/0 ns, adjustable in 500 ps increments  |              |
| Minimum state clock pulse width    |                | 3.5 ns  |              |
| Time tag resolution <sup>3</sup>   |                | 8 ns or 0.1% (whichever is greater)   |              |
| Max. time count between states     |                | 34.4 s  |              |
| Max. state tag count <sup>3</sup>  |                | 4.29 × 10 <sup>9</sup> states   |              |
| Triggering                         |                |   |              |
| Timing sequence levels             |                | 10  |              |
| State sequence levels              |                | 12  |              |
| Pattern recognizers                |                | 10  |              |
| Range recognizers                  |                | 2, each 32 bits wide  |              |
| Edge/Glitch recognizers            |                | 2 (timing mode only)  |              |
| Max. occurrence counter value      |                | 1,048,575   |              |
| Timers                             |                | 2   |              |
| Timer value range                  |                | 400 ns to 500 s   |              |
| Probes                             |                |   |              |
| Input resistance                   |                | 100 kΩ, ±2%   |              |
| Input capacitance                  |                | ~8 pF   |              |
| Minimum voltage swing              |                | 500 mVp-p   |              |
| Threshold range                    |                | ±6.0 V, adjustable in 50 mV increments  |              |
| Input/Output                       |                |   |              |
| I/O Ports                          |                | Centronics, RS-232, HP-IB and HIL for mouse and keyboard (optional)                                       |              |
| External arming                    |                | Input and output BNC connections with TTL signal levels   |              |
| Programmability                    |                | Fully programmable via RS-232 or HP-IB interface  |              |
| Mass storage                       |                | High-density, DOS/LIF format, 1.44 MB flexible disk drive   |              |
| File types                         |                | TIFF, PCX and PostScript screen image files, ASCII data files and binary-encoded data/configuration files |              |
| Physical factors                   |                |   |              |
| Dimensions                         |                | 218 mm H x 440 mm W x 367 mm D<br>(8.6 x 17.3 x 14.5 in)  |              |
| Weight                             |                | ~11.8 kg (26 lbs)   |              |
| Warranty                           |                | 1 year  |              |
| Ordering information               |                |   |              |
| HP 1664A 34-Channel logic analyzer | \$4,600.00 ea. | HP E2427A HIL Keyboard kit  | \$195.00 ea. |
| Opt. OB3 Service manual            | 55.00 ea.      | HP 1180B Testmobile   | 375.00 ea.   |
| Opt. UK9 Front panel cover         | 40.00 ea.      | HP 35183A Work surface for HP 1180B   | 50.00 ea.    |
| Opt. 1CM Rack mount kit            | 305.00 ea.     |   |              |

<sup>1</sup>Maximum state analysis speed does not change when time tags or state tags are used.

<sup>2</sup>Minimum setup/hold window is specified for single-edge, single-clock acquisition. Single-clock, multi-edge setup/hold window is 4.0 ns. Multiclock, multi-edge setup/hold window is 4.5 ns.

<sup>3</sup>Use of time tags or state tags will halve the memory depth.

<sup>1</sup>Maximum state analysis speed does not change when time tags or state tags are used.

<sup>2</sup>Minimum setup/hold window is specified for single-edge, single-clock acquisition. Single-clock, multi-edge setup/hold window is 4.0 ns. Multiclock, multi-edge setup/hold window is 4.5 ns.

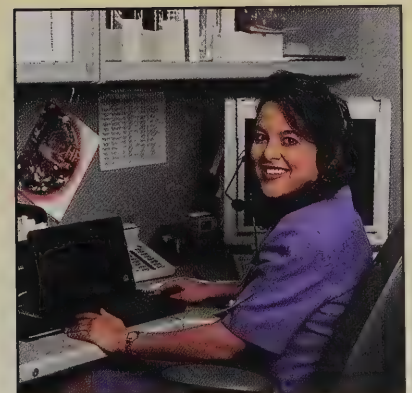
<sup>3</sup>Use of time tags or state tags will halve the memory depth.

## A solution for every digital design.

HP has a solution for virtually every digital application, from industrial automation to general-purpose computing.

The HP 1664A you see here is just one of the products in the HP 1660-series. Other analyzers in the family offer up to 136 channels, simultaneous state and timing analysis and 100 MHz state analysis speed, giving you the power to handle the newest digital and mixed-mode designs.

The engineers here at HP DIRECT are ready to answer your logic analysis questions — and be sure to ask for our free logic accessories brochure, which features more than 200 connection solutions for micro-processors and data buses.



SHANDA SAGE  
BSEE, University of Colorado

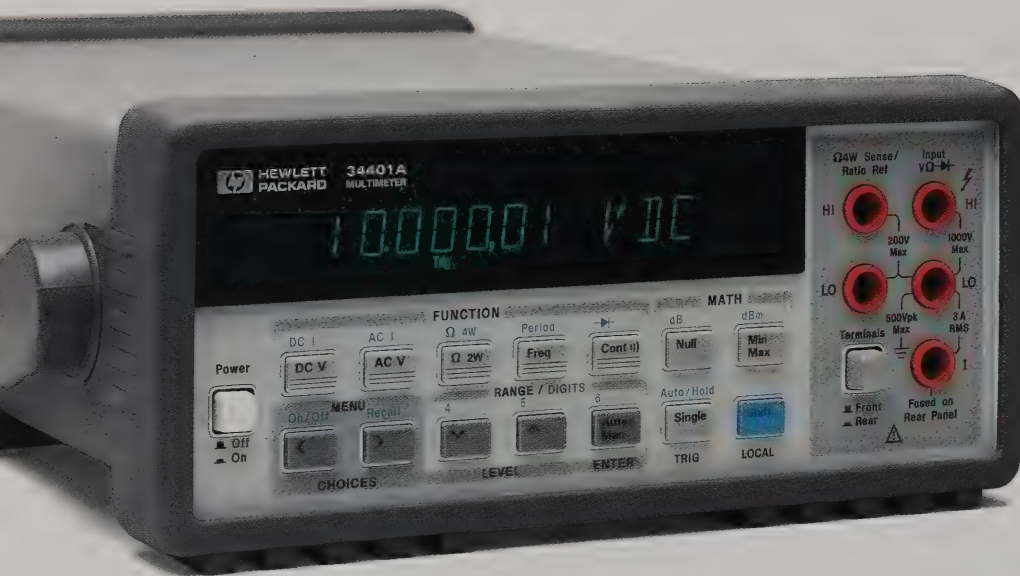
## Within budget, without compromise.

Make sure you get the right tools  
for digital design and test;  
call HP DIRECT at

# 1-800-452-4844



# 6<sup>1</sup>/<sub>2</sub> digit accuracy at a 5<sup>1</sup>/<sub>2</sub> digit price.



- Catch the details that slip past less accurate meters — without paying more
- Save time with easy-access features and built-in test functions
- Up to 1,000 readings per second direct to HP-IB

Only  
**\$995**

Getting accuracy in a DMM used to mean spending big. Not anymore. For the price of a 5<sup>1</sup>/<sub>2</sub> digit DMM, you can now get the top-quality 6<sup>1</sup>/<sub>2</sub> digit HP 34401A. And you can rest easy, knowing that the last measurement of the day will be as accurate as the first: 24-hour accuracy is 0.0015% for dc volts and 0.06% for ac.

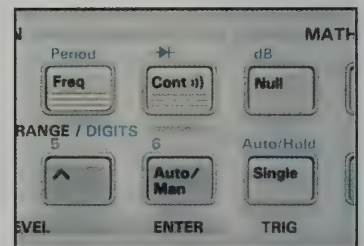
The HP 34401A boosts your productivity by combining time-saving features with an easy-access user interface. One or two button presses give you a wide array of functions, from dc volts to frequency to dB and dBm. Advanced tests include limit checks that can

drive a TTL output, min/max/avg readouts, and dc voltage ratios.

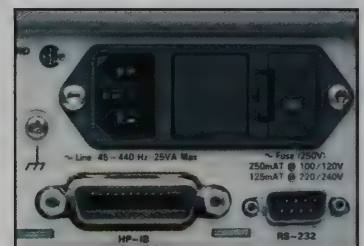
You'll save time putting the HP 34401A into a system, too. Standard Commands for Programmable Instruments (SCPI) as well as HP 3478A and Fluke 8840/8842A command languages are built in, so you won't have to rewrite your existing test software.

Speaking of time, we back the HP 34401A for a full three years (unlike the one- or two-year warranties you'll find on other DMMs).

**Within budget,  
without compromise.**



*All the measurements you expect, plus features that make checkout on the bench easy.*

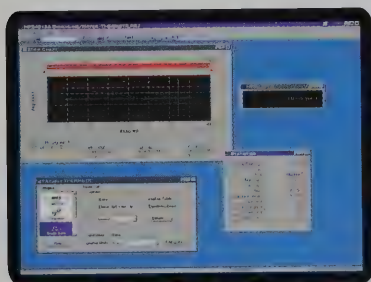


*Both HP-IB and RS-232 interfaces are standard.*



| HP 34401A Multimeter                |   |   |                  |
|-------------------------------------|---|---|------------------|
| Range                               | Resolution: 6½ digits<br>(or freq. for ac volts)            | Accuracy: 1 year<br>±(% of reading + % of range)              |                  |
| <b>dc voltage</b>                   |   |   |                  |
| 100 mV                              | 100 nV  | 0.0050 + 0.0035   | Input resistance |
| 1 V                                 | 1 µV  | 0.0040 + 0.0007   | 10 MΩ or >10 GΩ  |
| 10 V                                | 10 µV   | 0.0035 + 0.0005   | 10 MΩ or >10 GΩ  |
| 100 V                               | 100 µV  | 0.0045 + 0.0006   | 10 MΩ            |
| 1000 V                              | 1 mV  | 0.0045 + 0.0010   | 10 MΩ            |
| <b>True rms ac voltage</b>          |   |   |                  |
| 100 mV                              | 3 Hz–5 Hz   | 1.00 + 0.04   |                  |
|                                     | 5 Hz–10 Hz  | 0.35 + 0.04   |                  |
|                                     | 10 Hz–20 kHz  | 0.06 + 0.04   |                  |
|                                     | 20 kHz–50 kHz   | 0.12 + 0.04   |                  |
|                                     | 50 kHz–100 kHz  | 0.60 + 0.08   |                  |
|                                     | 100 kHz–300 kHz   | 4.00 + 0.50   |                  |
|                                     | for 1 V–750 V ranges  | 1.00 + 0.03   |                  |
|                                     | 3 Hz–5 Hz   | 0.35 + 0.03   |                  |
|                                     | 5 Hz–10 Hz  | 0.06 + 0.03   |                  |
|                                     | 10 Hz–20 kHz  | 0.12 + 0.05   |                  |
|                                     | 20 kHz–50 kHz   | 0.60 + 0.08   |                  |
|                                     | 50 kHz–100 kHz  | 4.00 + 0.50   |                  |
| <b>Resistance</b>                   |   |   |                  |
| 100 Ω                               | 100 µΩ  | 0.010 + 0.004   | Current Source   |
| 1 kΩ                                | 1 mΩ  | 0.010 + 0.001   | 1 mA             |
| 10 kΩ                               | 10 mΩ   | 0.010 + 0.001   | 1 mA             |
| 100 kΩ                              | 100 mΩ  | 0.010 + 0.001   | 100 µA           |
| 1 MΩ                                | 1 Ω   | 0.010 + 0.001   | 10 µA            |
| 10 MΩ                               | 10 Ω  | 0.040 + 0.001   | 5 µA             |
| 100 MΩ                              | 100 Ω   | 0.800 + 0.010   | 500 nA           |
| dc current                          | 10 mA to 3 A ranges   |   |                  |
| ac current                          | 1 A to 3 A ranges   |   |                  |
| Frequency and period                | 3 Hz (0.333 s) to 300 kHz (3.33 µs)                         |   |                  |
| Continuity                          | 1000 Ω range, threshold variable from 1 Ω to 1 kΩ           |   |                  |
| Diode test                          | 1 V range, 1 mA test current                                |   |                  |
| Math functions                      | Null, min/max/avg, dBm, dB, limit test                      |   |                  |
| Other features                      | Automatic reading hold, 512 readings storage, dcV–dcV ratio |   |                  |
| Maximum input                       | dc and ac voltage<br>dc and ac current                      | 1000 Vdc, 750 rms ac<br>3 A, from <250 V source, double fused |                  |
| Shock and vibration                 | meets MIL-T-28800D, Type III, Class 5                       |   |                  |
| Power                               | 100/120/220/240 V, 45–65 Hz, 360–440 Hz                     |   |                  |
| Net weight                          | 3 kg (6.5 lbs)  |   |                  |
| Size                                | 88.5 mm H x 212.6 mm W x 348.3 mm D<br>(4 x 8.5 x 14 in)    |   |                  |
| Warranty                            | 3 years   |   |                  |
| <b>Ordering information</b>         |   |   |                  |
| HP 34401A Multimeter                | \$995.00 ea.  | HP 34130A Deluxe test lead set                                | \$35.00 ea.      |
| Opt. 908 Rack mount kit             | 52.00 ea.   | HP 34161A Accessory pouch                                     | 38.00 ea.        |
| Opt. 910 Extra manual set           | 36.00 ea.   | HP 34812A BenchLink Meter                                     | 295.00 ea.       |
| Opt. W50 Additional 2-year warranty | 45.00 ea.   | HP 34397A dc-to-ac Inverter                                   | 160.00 ea.       |

See page 41 for RS-232 and HP-IB cable needs.  
Get the most from your meter! See pages 26-27 for probes and other accessories.



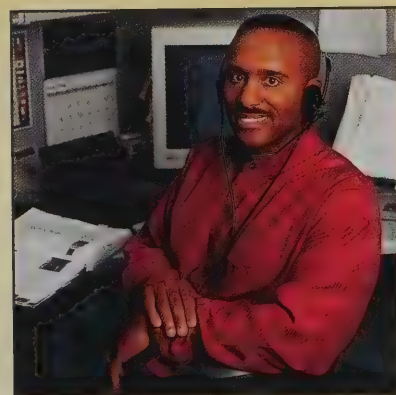
*For a giant productivity leap, check out HP 34812A BenchLink Meter on page 36. This low-cost software package gives you graphing, basic statistics and data storage — with no programming.*

## The engineering that makes it possible.

Trying to boost performance while cutting production costs is one of those tough challenges all engineers like to sink their teeth into. On the HP 34401A DMM, the design team was handed the task of meeting the competition on price while beating them on performance.

The HP team started by leveraging the measurement engine from the 8-digit HP 3458A DMM. This created a precision acquisition subsystem, without the time and expense of designing one from the ground up.

Their manufacturing colleagues pitched in to find faster, simpler ways to build DMMs. Even simple things such as replacing screws with snap-together parts helped drive costs down without compromising quality.



**HARDY GRIFFIN**  
BSEE, Colorado State University

Put more measurement power on your bench; Call HP DIRECT at  
**1-800-452-4844**



# Put benchtop features in the palm of your hand

The HP 970-series handheld multimeters offer the accuracy and capability you'd expect to find in benchtop units costing much more.

Check out the high resolution temperature function ( $^{\circ}\text{F}$  or  $^{\circ}\text{C}$ ), the autodiode feature that automatically reverses polarity when checking diode junctions, and the min/max feature that records elapsed time and alerts you when a min or max is recorded.

Rely on basic dc accuracy from 0.3% to 0.05%, frequency response to 100 kHz, resolution as precise as 10  $\mu\text{V}$  and true rms with ac+dc that means higher accuracy for nonsinusoidal waveforms.

Use your new meter with confidence, too. The innovative safety shutter prevents accidental connection to the current terminals, and offers high-energy fuses and audible warnings for input overloads.

*The protective boot keeps your handheld safe so you can focus on your work.*



**HP 971A - \$195**

- Rugged design for reliable operation in harsh environments
- Sealed package protects the internal electronics
- Wide array of accurate measurements at a low price



**HP 972A - \$245**

- Voltage ranges as low as 40 mV for high resolution
- 20 kHz frequency response
- Dedicated capacitance tester (from 10 nF to 1000  $\mu\text{F}$ )



**HP 973A - \$290**

- 3 1/2 digit display
- 0.1% basic dc accuracy
- True rms and ac+dc measurements
- Thermocouple temperature measurements



**HP 974A - \$370**

- 4 1/2 digit display
- Includes true rms and ac+dc measurements, up to 100 kHz
- Basic dc accuracy of 0.05%



hand.

| HP E2373A, HP 971A, HP 972A, HP 973A and HP 974A Handheld Multimeters  |                             |                             |   |                             |                              |
|--|-----------------------------|-----------------------------|---|-----------------------------|------------------------------|
| Model  | HP E2373A                   | HP 971A                     | HP 972A   | HP 973A                     | HP 974A                      |
| Display count  | 3,200                       | 4,000                       | 4,000   | 4,000                       | 49,999                       |
| Basic accuracy   |                             |                             |   |                             |                              |
| dc voltage   | 0.7%                        | 0.3%                        | 0.2%  | 0.1%                        | 0.05%                        |
| ac voltage   | 1.2%                        | 1%                          | 0.5%  | 0.7%                        | 0.5%                         |
| Ohms   | 0.7%                        | 0.5%                        | 0.2%  | 0.2%                        | 0.06%                        |
| Capacitance  | —                           | —                           | 1.2%  | 1.2%                        | —                            |
| Frequency response (ac volts)  | 500 Hz                      | 1 kHz                       | 20 kHz  | 20 kHz                      | 100 kHz                      |
| Resolution/maximum   |                             |                             |   |                             |                              |
| dc voltage   | 100 $\mu$ V/1000 V          | 100 $\mu$ V/1000 V          | 10 $\mu$ V/1000 V                                       | 10 $\mu$ V/1000 V           | 10 $\mu$ V/1000 V            |
| ac voltage   | 1 mV/750 V                  | 100 $\mu$ V/1000 V          | 10 $\mu$ V/1000 V                                       | 10 $\mu$ V/1000 V           | 10 $\mu$ V/750 V             |
| Ohms   | 0.1 $\Omega$ /30 M $\Omega$ | 0.1 $\Omega$ /40 M $\Omega$ | 0.1 $\Omega$ /40 M $\Omega$                             | 0.1 $\Omega$ /40 M $\Omega$ | 0.01 $\Omega$ /50 M $\Omega$ |
| Current  | 10 $\mu$ A/10 A             | 100 nA/10 A                 | 100 nA/10 A   | 100 nA/10 A                 | 10 nA/10 A                   |
| Elapsed time   | —                           | 1 min/1999 min              | 1 min/1999 min  | 1 min/1999 min              | 1 sec/9999 min               |
| Frequency  | —                           | 1 Hz/100 kHz                | 0.01 Hz/200 kHz   | 0.01 Hz/200 kHz             | 0.01 Hz/200 kHz              |
| Safety shutter   |                             | •                           | •   | •                           | •                            |
| High-energy fuse, overload alert   |                             | •                           | •   | •                           | •                            |
| Relative, percent  |                             | •                           | •   | •                           | •                            |
| Min/max, average   |                             | •                           | •   | •                           | •                            |
| Hold, autohold   |                             | •                           | •   | •                           | •                            |
| Bargraph   | •                           | •                           | •   | •                           | •                            |
| Thermistor temp.   |                             | •                           | •   | •                           | •                            |
| Thermocouple temp.   |                             |                             |   | •                           |                              |
| Dual digital display   |                             |                             | •   | •                           |                              |
| True rms ac response   |                             |                             |   | •                           | •                            |
| ac + dc  |                             |                             |   | •                           | •                            |
| dBm/dB   |                             |                             |   | •                           | •                            |
| Warranty   | 3 years                     |                             |   |                             |                              |
| Ordering information   |                             |                             |   |                             |                              |
| HP E2373A Handheld multimeter  | \$99.00 ea.                 |                             | HP E2304A Soft carrying case                            | \$19.00 ea.                 |                              |
| HP 971A Handheld multimeter  | 195.00 ea.                  |                             | HP E2306A Deluxe test lead kit                          | 35.00 ea.                   |                              |
| HP 972A Handheld multimeter  | 245.00 ea.                  |                             | HP E2307A Thermocouple bead probe type-K (HP 973A only) | 25.00 ea.                   |                              |
| HP 973A Handheld multimeter  | 290.00 ea.                  |                             | HP E2308A Thermistor temperature probe                  | 35.00 ea.                   |                              |
| HP 974A Handheld multimeter  | 370.00 ea.                  |                             |   |                             |                              |
| Opt. W50 Additional 2-year warranty  | 45.00 ea.                   |                             |   |                             |                              |
| Note: All HP 970-series multimeters have Vdc, Vac, ac/dc current, ohms, continuity, diode test, autodiode test, temperature °F and °C, frequency, auto/manual ranging, autopower off, secondary display for range and min/max, and 3-year warranty. Standard accessories include a pair of test leads, operating and calibration manual, Certificate of Calibration, spare fuse, and rubber boot. Two 1.5 V AA alkaline batteries installed. |                             |                             |   |                             |                              |
| The HP E2373A has Vdc, Vac, ac/dc current, ohms, continuity, diode test, auto/manual ranging, and a 3-year warranty. Standard accessories include a pair of test leads, manual, spare fuse, and installed batteries.   |                             |                             |   |                             |                              |

**HP E2373A - \$99**

- HP's lowest price multimeter
- Bargraph display
- 3-year warranty



Complete your tool kit with an  
HP handheld; call HP DIRECT at  
**1-800-452-4844**

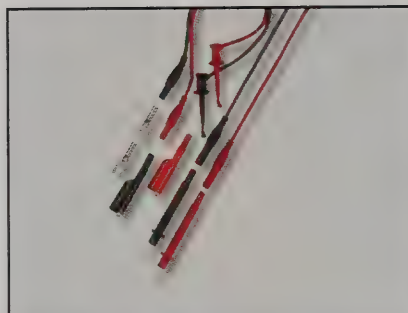


# Equip your handheld or benchtop DMM w



**HP 34397A 12 V dc to 115 V ac Inverter**.....\$160.00 ea.  
**Option 0E3 230 V ac output**

- Power instruments from a cigarette lighter
- Input range: 10.5 to 15 V
- Output: 100 W max at 115 Vac



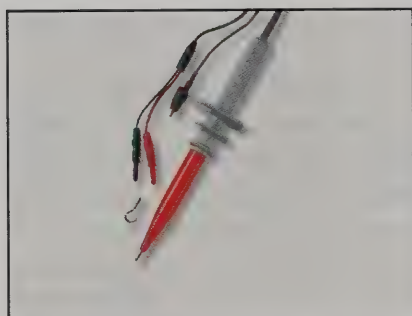
**HP 34130A Deluxe Test Lead Set**.....\$35.00 ea.

- Test leads are 1.2 m (47 in) long with fixed sheath on banana plugs
- Ideal for the HP 34401A DMM



**HP 34161A Accessory Pouch**.....\$38.00 ea.

- Cordura® pouch holds leads & other accessories
- Fits on top of HP 34401A DMM, HP 53100-series counters and HP 33120A function/arb generator



**HP 34300A 40 kV ac/dc High-Voltage Probe**.....\$90.00 ea.

- 40 kVdc, 40 kVac to 150 Hz
- 1000:1 division
- For any DMM with 10 M $\Omega$  inputs



**HP 34301A 100 kHz to 700 MHz RF Detector Probe**.....\$80.00 ea.

- Range: 50 Vrms, accuracy:  $\pm 2$  dB to 700 MHz
- 1 Vdc output for 1 Vrms input
- For any DMM with 10 M $\Omega$  inputs



**HP 34302A Clamp-on ac/dc Current Probe**.....\$250.00 ea.

- Two ranges:  $\pm 10$  A,  $\pm 100$  A (ac, dc, or ac + dc)
- Bandwidth: 1 kHz
- Banana jack output – use with any DMM



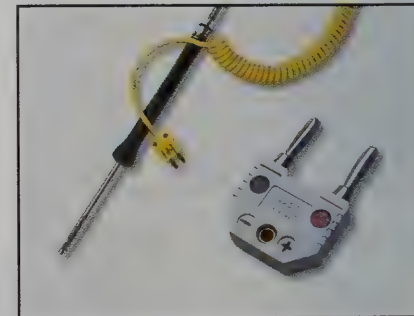
**HP E2304A Handheld Multimeter Carrying Case**.....\$19.00 ea.

- Padded case with dual zipper
- Snap-on belt strap
- Fits all HP handhelds



**HP E2306A, Deluxe Test Lead Kit**.....\$35.00 ea.  
**HP E2305A Spare Test Leads 2 pairs (not shown)**.....\$15.00 ea.

- Right-angle shrouded banana plugs
- For use with the HP 970-series handhelds

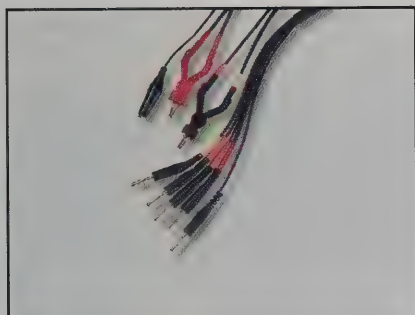


**HP E2301A Surface Type-K Thermocouple Probe**.....\$120.00 ea.  
**HP E2303A SMP-to-Dual Banana Plug Adapter**.....\$12.00 ea.

- Basic accuracy:  $\pm 2.2^\circ$  C ( $4^\circ$  F)
- Probe must be used with the HP E2303A
- For use with the HP 973A handheld only

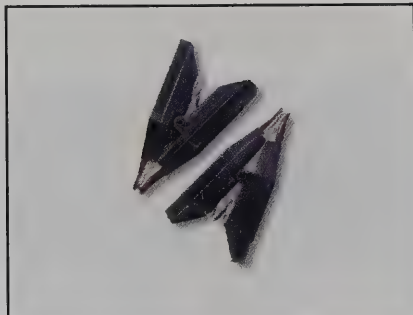


# h quality HP accessories.



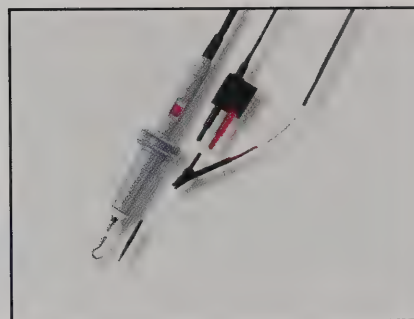
**HP 11059A Kelvin Probe Set.....\$135.00 ea.**

- Works with any DMM with 4-wire  $\Omega$  function
- Gold-plated flat tweezers ensure precise contact
- Maximum input: 42 V



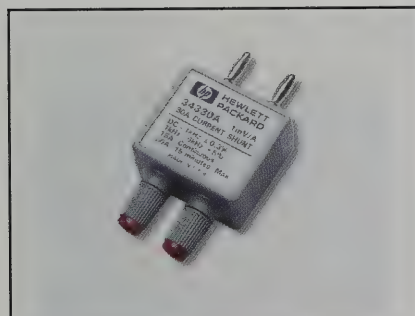
**HP 11062A Kelvin Clip Set .....\$26.00 ea.**

- Construct your own Kelvin probe set for 4-wire  $\Omega$  measurements
- Contains two silver-plated flat tweezer clips



**HP 34119A 5 kV ac/dc High-Voltage Probe .....\$130.00 ea.**

- 5 kVdc, 5 kVac to 1 MHz
- 1000:1 division
- For any DMM with 10 M $\Omega$  inputs



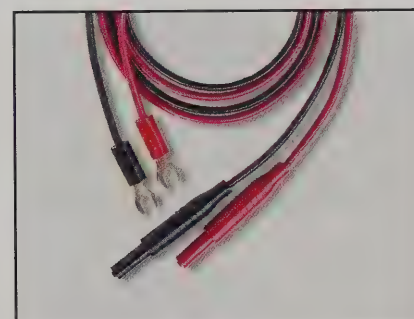
**HP 34330A 30 A Current Shunt.....\$55.00 ea.**

- 1 mV/A output
- 15 A continuous, 30 A for 15 minute max
- Use with any DMM



**HP 11060A Surface Mount Device Probe .....\$24.00 ea.**

- Maximum input: 42 V
- Use with any DMM



**HP 11053A Lug-to-Lug Jumpers .....\$29.00 ea.**  
**HP 11174A Lug-to-Banana Jumpers .....\$29.00 ea.**  
**HP 11058A Banana-to-Banana Jumpers .....\$29.00 ea.**

- HP 11053A minimizes thermal errors
- Banana plugs have retractable sheaths
- Use with any DMM



**HP E2307A Type-K Thermocouple Bead Temperature Probe.....\$25.00 ea.**

- Basic accuracy:  $\pm 2.2^{\circ}\text{C}$  ( $4^{\circ}\text{F}$ )
- For use with HP 973A handheld only



**HP E2308A Thermistor Temperature Probe .....\$35.00 ea.**

- 5 k $\Omega$  at  $25^{\circ}\text{C}$
- Basic accuracy:  $\pm 0.2^{\circ}\text{C}$  ( $0.4^{\circ}\text{F}$ )
- For use with HP 970-series handhelds only

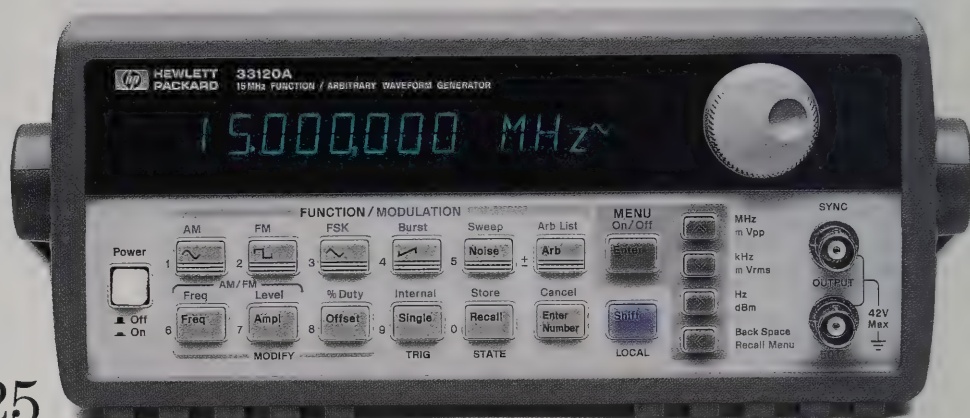
**Make sure you have the right accessories; call HP DIRECT at  
1-800-452-4844**



# Clean, stable waveforms — and if you do

- 10 standard waveforms, with sine and square to 15 MHz
- Build arbitrary waveforms with 40 MSa/s speed and storage for four 16,000-point waveforms
- Clean signals: THD less than 0.04% and flatness as low as  $\pm 0.1$  dB

Only  
**\$1,725**



The HP 33120A function/arb generator offers the rock-solid stability of digital synthesis at a price even your accounting department will feel good about.

And not only do you get better performance, you get arbitrary waveforms available for the first time in this price range. Just imagine the ways you could use complex custom waveforms (with 12-bit resolution), from simulating heartbeats and vibrations to testing circuits in ways never before possible at this price.

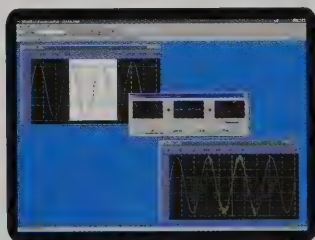
Low cost doesn't have to mean messy harmonics and other extra baggage, either. Try to find another function/arb

generator that matches the HP 33120A's harmonic distortion specs at this price.

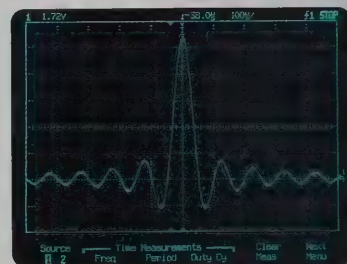
Sweep and modulation expand your test options without expanding your equipment list. Plus, you get full programmability using Standard Commands for Programmable Instruments (SCPI) with standard HP-IB and RS-232.

The Option 001 phase lock/timebase increases the HP 33120A's frequency stability and creates new system

possibilities. Generate precise phase-offset signals, phase lock two HP 33120As, sync your generator to a 10 MHz frequency standard, or you can even tie an entire ATE system to a master clock.



*HP BenchLink Arb software lets you create waveforms with simple drawing tools or data imported from other programs. See page 36.*



*A built-in 16 k-deep arbitrary waveform generator handles your custom waveform needs.*



*Internal AM, FM, FSK, and burst modulation eliminate the need for a second modulation source.*

**Within budget,  
without compromise.**



It's not like ours, make your own.

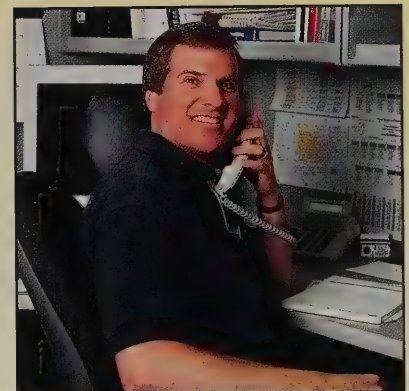
| HP 33120A Function/Arbitrary Waveform Generator |  |                                     |                                   |  |
|---|--|-------------------------------------|-----------------------------------|--|
| <b>Waveforms</b>                                |  |                                     |                                   |  |
| Standard  | Sine, square, triangle, ramp, noise, sin(x)/x exponential rise and fall, cardiac, dc volts |                                     |                                   |  |
| <b>Arbitrary</b>                                |  |                                     |                                   |  |
| Waveform length                                 | 8 to 16,000 points   |                                     |                                   |  |
| Nonvolatile memory                              | Four waveforms (each from 8 to 16,000 points)  |                                     |                                   |  |
| Amplitude resolution                            | 12 bits  |                                     |                                   |  |
| Sample rate                                     | 40 MSa/s   |                                     |                                   |  |
| <b>Frequency characteristics</b>                |  |                                     |                                   |  |
| Sine  | 100 $\mu$ Hz–15 MHz  | White noise                         | 10 MHz bandwidth                  |  |
| Square  | 100 $\mu$ Hz–15 MHz  | Resolution                          | 10 $\mu$ Hz or 10 digits          |  |
| Triangle  | 100 $\mu$ Hz–100 kHz   | Accuracy                            | 10 ppm in 90 days                 |  |
| Ramp  | 100 $\mu$ Hz–100 kHz   |                                     | (18 °C–28 °C)                     |  |
| <b>Sinewave</b>                                 |  |                                     |                                   |  |
| Harmonic distortion                             |  |                                     |                                   |  |
| dc to 20 kHz                                    | –70 dBc  |                                     |                                   |  |
| 20 kHz to 100 kHz                               | –60 dBc  |                                     |                                   |  |
| 100 kHz to 1 MHz                                | –45 dBc  |                                     |                                   |  |
| 1 MHz to 15 MHz                                 | –35 dBc  |                                     |                                   |  |
| THD dc to 20 kHz                                | <0.04%   |                                     |                                   |  |
| <b>Output characteristics</b>                   |  |                                     |                                   |  |
| Amplitude                                       |  |                                     |                                   |  |
| (into 50 $\Omega$ )                             | 50 mVp-p–10 Vp-p   |                                     |                                   |  |
| (into open circuit)                             | 100 mVp-p–20 Vp-p  |                                     |                                   |  |
| Accuracy (at 1 kHz)                             | $\pm 1\%$ of specified output  |                                     |                                   |  |
| Flatness (sinewave relative to 1 kHz)           |  |                                     |                                   |  |
| < 100 kHz                                       | $\pm 1\%$ (0.1 dB)   |                                     |                                   |  |
| 100 kHz to 1 MHz                                | $\pm 1.5\%$ (0.15 dB)  |                                     |                                   |  |
| 1 MHz to 15 MHz                                 | $\pm 2\%$ (0.2 dB)   |                                     |                                   |  |
| <b>Modulation</b>                               |  |                                     |                                   |  |
| AM  |  | FSK                                 |                                   |  |
| Carrier –3 dB Frequency                         | 15 MHz (typical)   | Internal Rate                       | 10 mHz–50 kHz                     |  |
| Modulation                                      | Any internal waveform including Arb  | Deviation                           | 10 mHz–15 MHz                     |  |
| Frequency                                       | 10 mHz–20 kHz  | Source                              | Internal/external (1 MHz max.)    |  |
| Depth   | 0%–120%  | Burst                               |                                   |  |
| Source  | Internal/external  |                                     |                                   |  |
| FM  |  | Carrier Frequency                   | 5 MHz max.                        |  |
| Modulation                                      | Any internal waveform including Arb  | Count                               | 1 to 50,000 cycles                |  |
| Frequency                                       | 10 mHz–10 kHz  | Start Phase                         | –360° to +360°                    |  |
| Deviation                                       | 10 mHz–15 MHz  | Internal Rate                       | 10 mHz–50 kHz $\pm 1\%$           |  |
| Source  | Internal only  | Gate Source                         | Internal/external gate            |  |
|   |  | Trigger Source                      | Single, external or internal rate |  |
| <b>Option 001 Phase Lock/TCXO Timebase</b>      |  |                                     |                                   |  |
| Timebase accuracy                               |  |                                     |                                   |  |
| Stability                                       | $\pm 1$ ppm 0 °C–50 °C   |                                     |                                   |  |
| Aging   | <2 ppm in first 30 days (continuous op)  |                                     |                                   |  |
|   | 0.1 ppm/month (after first 30 days)  |                                     |                                   |  |
| External reference/Input                        |  |                                     |                                   |  |
| Lock range                                      | 10 MHz $\pm 50$ Hz   |                                     |                                   |  |
| Internal reference/Output                       |  |                                     |                                   |  |
| Frequency                                       | 10 MHz   |                                     |                                   |  |
| <b>Power</b>                                    | 100 V/120 V/220 V/240 V  |                                     |                                   |  |
| <b>Net weight</b>                               | 4 kg (8.8 lbs)   |                                     |                                   |  |
| <b>Size</b>                                     | 254.4 mm W x 103.6 mm H x 374 mm D<br>(10.0 x 4.0 x 15.1 in)                               |                                     |                                   |  |
| <b>Warranty</b>                                 | 3 years  |                                     |                                   |  |
| <b>Ordering information</b>                     |  |                                     |                                   |  |
| HP 33120A Function/Arb generator                | \$1,725.00 ea.   | Opt. W50 Additional 2-year warranty | \$45.00 ea.                       |  |
| Opt. 001 Phase Lock/TCXO Timebase               | 395.00 ea.   | Opt. 910 Extra manual set           | 36.00 ea.                         |  |
| Opt. 106 HP 34811A BenchLink Arb software       | 295.00 ea.   | HP 34161A Accessory pouch           | 38.00 ea.                         |  |
| (can also be ordered separately as HP 34811A)   |  | HP 34397A dc-to-ac Inverter         | 160.00 ea.                        |  |
| Opt. 1CM Rack mount kit                         | 52.00 ea.  |                                     |                                   |  |
| See page 41 for RS-232 and HP-IB cable needs.   |  |                                     |                                   |  |

See page 41 for RS-232 and HP-IB cable needs.

## Manufactured to reduce cost — not capability.

When our engineers design low-cost products, manufacturing time is one of their top concerns. After all, money we squeeze out of the production process is money that stays in your pocket.

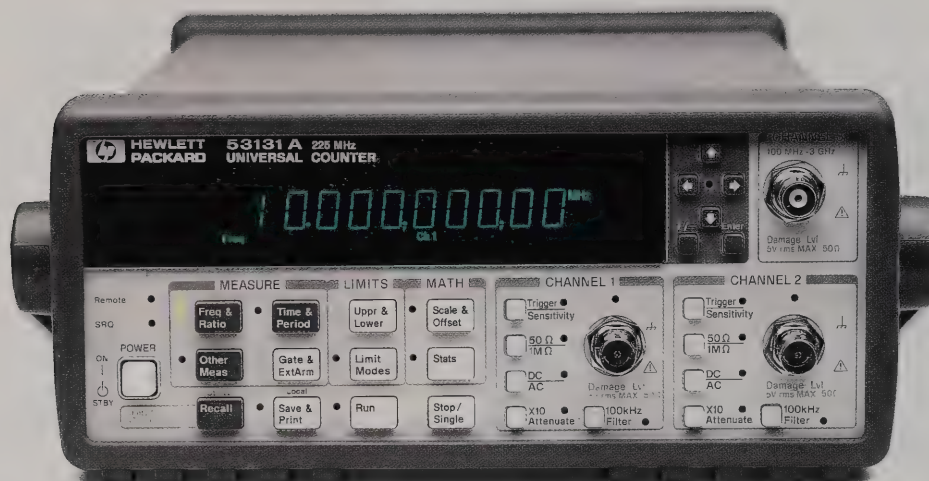
For the HP 33120A, specialists from R&D, production, and quality assurance started with the goal of creating a no-compromises product that could be manufactured quickly and efficiently. They finished with a function generator that we can assemble in less than one-third the time its predecessor took. The new design cuts test time in half, too.



ROGER NURSEY  
BSEE, University of South Florida

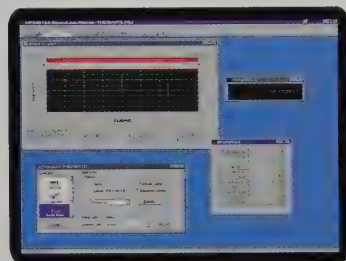
For all the details of function generators, call HP DIRECT at  
**1-800-452-4844**

# Save time with fast measurements and fast



The **HP 53131A** offers 10 digits/second resolution at up to 225 MHz on two channels (with an optional 3 or 5 GHz third channel) and a variety of measurements, from frequency, time interval and pulse parameters to phase angle and totalize.

The HP 53100-series counters use real-time digital signal processing to analyze data while simultaneously taking new readings. So while other counters are stuck in processing "dead time," these HP counters have already moved on to the next measurement. And with continuous HP-IB data transfer rates of more than 200 measurements per second, you'll get the job done in a hurry.



Add graphics, archiving and more statistical analysis with HP BenchLink Meter. See page 36.

Automated limit tests, instant recall of test setups and one-button access to the features you need most simplify your work. Plus, you can perform statistics on all measurements and simultaneously measure and track average, min/max and standard deviation.

Choose the combination of performance and capability that fits your budget.

- Resolution of 10 or 12 digits/second; frequency ranges up to 5 GHz
- Versatile test and analysis features help you extract information from your measurement data
- Choice of three models to fit your needs and budget

Only  
**\$1,725**



The **HP 53132A** offers the same measurement set as the HP 53131A, with up to 12 digits/second resolution — and 150 ps time interval resolution.



The value-priced **HP 53181A** RF counter provides 10 digits/second up to 225 MHz, with the option of 1.5, 3 and 5 GHz second channel.



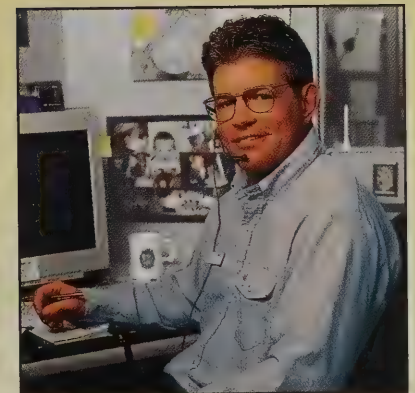
# data transfers.

| HP 53131A, HP 53132A 225 MHz Universal Counters and HP 53181A 225 MHz RF Counter |  |  |   |
|--|--|--|---|
|  | HP 53131A  | HP 53132A                              | HP 53181A   |
| Measurements   | Frequency, frequency ratio, time interval, period, rise/fall time, positive/negative pulse width, duty cycle, phase (CH 1 to CH 2), totalize, peak voltage, time interval average, time interval delay |  | Frequency, frequency ratio (with optional CH 2), period, peak voltage |
| Analysis   | Automatic limit testing, math (scale and offset), statistics (minimum, maximum, mean, standard deviation). Statistics available on all measurements or only measurements that fall within limits.      |  |   |
| Measurement characteristic   |  |  |   |
| Frequency range  | CH 1 & 2: dc–225 MHz   | CH 1 & 2: dc–225 MHz                   | CH 1: dc–225 MHz  |
| Frequency resolution   | 10 digits/s  | 12 digits/s                            | 10 digits/s   |
| Measurement speed  | Up to 200 meas/s   | Up to 200 meas/s                       | Up to 200 meas/s  |
| Time interval resolution (LSD)   | 500 ps   | 150 ps                                 | NA  |
| Input conditioning   | (Independently selectable on CH 1 & 2)   | (Independently selectable on CH 1 & 2) | (Selectable on CH 1)  |
| Impedance, coupling  | 1 M $\Omega$ or 50 $\Omega$ , ac or dc   | 1 M $\Omega$ or 50 $\Omega$ , ac or dc | 1 M $\Omega$ or 50 $\Omega$ , ac or dc                                |
| Low pass filter  | 100 kHz, switchable  | 100 kHz, switchable                    | 100 kHz, switchable   |
| Attenuation  | $\times 1$ or $\times 10$  | $\times 1$ or $\times 10$              | $\times 1$ or $\times 10$   |
| External timebase reference input  | 1, 5, 10 MHz   | 10 MHz                                 | 1, 5, 10 MHz  |
| Trigger  | CH 1 & 2<br>Trigger on rising/falling edge; set level by percent of signal level or absolute voltage; set sensitivity to LOW, MED, or HIGH   | CH 1 & 2                               | CH 1  |
| Gating and arming  | Auto, manual (set gate time or number of digits of resolution); external; delay  |  |   |
| Interfaces   | Standard HP-IB (IEEE 488.1 and 488.2) with SCPI-compatible language; talk only RS-232  |  |   |
| Power  | 90–132 Vac; 45–66 Hz or 360–440 Hz/198–264 Vac; 45–66 Hz   |  |   |
| Net weight   | 3 kg (6.5 lbs)   |  |   |
| Size   | 212.6 mm W x 88.5 mm H x 348.3 mm D (8.5 x 4.0 x 14.0 in)  |  |   |
| Warranty   | 3 years  |  |   |
| Ordering information   |  |  |   |
| HP 53131A 10 digits per second 225 MHz Universal counter                         |  |  | \$1,725.00 ea.  |
| HP 53132A 12 digits per second 225 MHz Universal counter                         |  |  | 2,495.00 ea.  |
| HP 53181A 10 digits per second 225 MHz RF counter                                |  |  | 1,500.00 ea.  |
| (counters include power cord, operating & programming manuals)                   |  |  |   |
| HP 34812A BenchLink Meter  |  |  | 295.00 ea.  |
| Opt. W50 Additional 2-year warranty* starts at                                   |  |  | 45.00 ea.   |
| Opt. 001 Medium-stability timebase   |  |  | 600.00 ea.  |
| Opt. 002 External dc power   |  |  | 250.00 ea.  |
| Opt. 010 High-stability timebase   |  |  | 900.00 ea.  |
| Opt. 012 Ultra-stability timebase  |  |  | 1,500.00 ea.  |
| Opt. 015 1.5 GHz Channel 2 with BNC connector (HP 53181A only)                   |  |  | 500.00 ea.  |
| Opt. 030 3 GHz Channel 3 with BNC connector (Channel 2 on HP 53181A)             |  |  | 800.00 ea.  |
| Opt. 050 5 GHz Channel 3 with type-N connector (Channel 2 on HP 53181A)          |  |  | 1,800.00 ea.  |
| HP 34397A dc-to-ac Inverter  |  |  | 160.00 ea.  |
| Complete your test system with quality HP cables; see page 41.                   |  |  |   |
| * Call HP DIRECT for more information on Opt. W50 prices.                        |  |  |   |

## Delivering innovative technology at an everyday price.

It would be just about impossible to create counters with this much performance at prices this low if you started from scratch. Fortunately, our engineers didn't have to. By leveraging innovative technology from HP's modulation domain analyzers (MDAs), they gave these low-cost counters top-of-line performance.

For instance, the MDA's signal processing algorithm (programmed into the HP 53100-series gate array) lets us offer up to 12 digits/second resolution in a value-priced counter. It's another example of how you can benefit from our resources and experience in the field of test and measurement.



PAUL RUTLEDGE  
BSEE, Texas A & M University

To find the counter that  
fits your measurement needs,  
call HP DIRECT at  
**1-800-452-4844**

# The end of the either/or compromise.

- Three dc outputs with 80 W total power
- Programmable, with HP-IB and RS-232 standard
- Clean, stable output signals, linear regulation

Tired of people asking you to choose, then charging you for the privilege? Now you can have it all with the new HP E3631A triple output dc power supply — and pay a lot less than you'd pay for some of those other supplies.

Operate the HP E3631A as a stand-alone bench supply, setting exact output levels quickly with the dual voltage and current meters. The 6-volt supply is completely isolated from the two 25-volt supplies, which you can track together, operate independently or operate as a single 50-volt supply.

Connect the HP E3631A to a PC or other controller via the built-in HP-IB or RS-232 port, and you'll have a versatile power source for automated test.

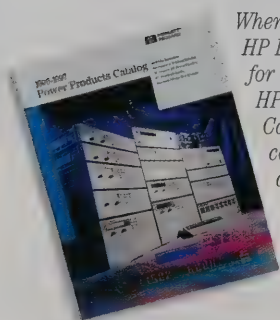
No matter how you use it, count on the HP E3631A to power your projects for a long time to come — we back it up with an industry-leading three-year warranty.

Only  
**\$995**



*You won't pay extra for HP-IB or RS-232; both are standard features on the HP E3631A.*

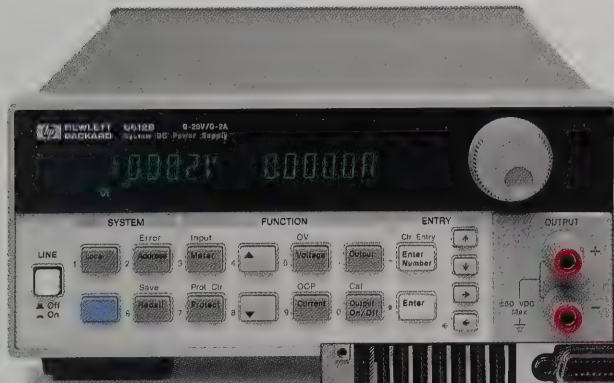
| HP E3631A Triple Output dc Power Supply                        |  | 1   | 2                       | 3                    |
|--|--|---|-------------------------|----------------------|
| <b>dc outputs</b>  |  |   |                         |                      |
| Voltage  |  | 0 to +25 V  | 0 to -25 V              | 0 to 6 V             |
| Current  |  | 0 to 1 A  | 0 to 1 A                | 0 to 5 A             |
| <b>Load and line regulation</b>                                |  |   |                         |                      |
| Voltage  |  |   | <0.01% + 2 mV           |                      |
| Current  |  |   | <0.01% + 250 $\mu$ A    |                      |
| <b>Ripple and noise</b>  |  |   |                         |                      |
| Normal mode voltage  |  |   | <350 $\mu$ Vrms/2 mVp-p |                      |
| Normal mode current  |  | <500 $\mu$ Arms   | <500 $\mu$ Arms         | <2 mArms             |
| Common mode current  |  |   | <1.5 $\mu$ Arms         |                      |
| <b>Programming accuracy</b>                                    |  |   |                         |                      |
| Voltage  |  | 0.05% + 20 mV   |                         | 0.1% + 5 mV          |
| Current  |  | 0.15% + 4 mA  |                         | 0.2% + 10 mA         |
| <b>Readback/meter accuracy</b>                                 |  |   |                         |                      |
| Voltage  |  | 0.05% + 10 mV   |                         | 0.1% + 5 mV          |
| Current  |  | 0.15% + 4 mA  |                         | 0.2% + 10 mA         |
| <b>Resolution</b>  |  |   |                         |                      |
| Program/readback   |  | 1.5 mV/0.1 mA   |                         | 0.5 mV/0.5 mA        |
| Meter  |  | 10 mV/1 mA  |                         | 1 mV/1 mA            |
| <b>Transient response</b>                                      |  | 50 $\mu$ s for output to recover to within 15 mV following a change in output current from full load to half load or vice versa |                         |                      |
| <b>Supplemental Characteristics</b>                            |  |   |                         |                      |
| <b>Command processing time</b>                                 |  | <100 ms   |                         |                      |
| <b>Voltage programming speed to within 0.1% of final value</b> |  | Full load   | No load                 | Full load    No load |
| Up   |  | 50 ms   | 20 ms                   | 11 ms    10 ms       |
| Down   |  | 45 ms   | 400 ms                  | 13 ms    200 ms      |
| <b>Isolation</b>   |  | $\pm$ 240 Vdc   |                         |                      |
| <b>Size</b>  |  | 132 mm H x 213 mm W x 360 mm D (5.2 x 8.4 x 14.2 in)  |                         |                      |
| <b>Weight</b>  |  | 8.2 kg (18 lbs)   |                         |                      |
| <b>Warranty</b>  |  | 3 years   |                         |                      |
| <b>Price</b>   |  | \$995   |                         |                      |



*When you call HP DIRECT, ask for a copy of the HP Power Products Catalog, which covers all of HP's ac sources, dc power supplies and electronic loads.*



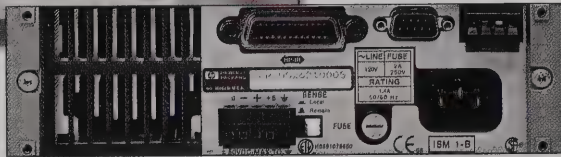
# Improve your tests, protect your circuits.



- Voltage range 0 to 20 V; current range -1 to +2 A
- High-speed programming reaches target output levels quickly
- Dual current range for both high sensitivity and high output

Only  
\$1,395

*The HP 6612B gets within 10% of target output values in less than 15 ms.*



When you program a power supply to change output levels, you expect it to change quickly and accurately. The new HP 6612B dc power supply won't let you down. It moves within 10% of the programmed value in less than 15 ms and within 0.025% in less than 60 ms. So you'll not only save time in repetitive testing, you'll also generate less heat buildup in the devices under test.

Programming won't cost you extra, either. Both HP-IB and RS-232 are standard, and the HP 6612B uses Standard Commands for Programmable Instruments (SCPI) to simplify your programming tasks.

Whether you run the HP 6612B manually or via computer, you can count on clean, dependable power. It's regulated to 2 mV and 0.5 mA and features ripple and noise of only 0.5 mVrms and 1 mArms.

The supply's two current ranges let you select sensitivity down to 2.5  $\mu$ A or output as high as 2 A. Overvoltage and overcurrent protection keep your components and systems safe, and the built-in readback meter lets you know where the supply is set, without the hassle of an external voltmeter or ammeter.

| HP 6612B dc Power Supply                     |   |
|--|---|
| <b>dc outputs</b>                            |   |
| Voltage                                      | 0 to 20 V   |
| Current                                      | -1A to 0 to +2A   |
| <b>Load and line regulation</b>              |   |
| Voltage                                      | 2 mV  |
| Current                                      | 0.5 mA  |
| <b>Ripple and noise</b>                      |   |
| Normal mode voltage                          | 0.5 mVrms/3 mVpp  |
| Normal mode current                          | 1.0 mArms   |
| <b>Programming accuracy</b>                  |   |
| Voltage                                      | 0.05% + 10 mV   |
| Current                                      | 0.15% + 3 mA  |
| <b>Readback/meter accuracy</b>               |   |
| Voltage                                      | 0.07% + 15 mV   |
| Current, low range $\pm 20$ mA               | 0.1% + 2.5 $\mu$ A  |
| high range -1 A to +2 A                      | 0.2% + .5 mA  |
| <b>Resolution, Programming and Readback</b>  |   |
| Voltage                                      | 5 mV  |
| Current, low range $\pm 20$ mA               | 1 $\mu$ A   |
| high range -1 A to +2 A                      | 5 mA  |
| <b>Programming speed</b>                     |   |
| Command processing time                      | < 20 ms   |
| Output response less command processing time |   |
| within 0.025% of final value                 | < 60 ms   |
| within 10% of final value                    | < 15 ms   |
| <b>Isolation</b>                             | $\pm 50$ Vdc  |
| <b>Size</b>                                  | 101 mm H $\times$ 212.8 mm W $\times$ 425.8 mm D (3.98 $\times$ 8.34 $\times$ 16.76 in)                             |
| <b>Weight</b>                                | 8.85 kg (19 lbs, 8 oz)  |
| <b>Warranty</b>                              | 3 years   |
| <b>Price</b>                                 | \$1,395   |
| <b>Options</b>                               | Opt 100: 87 to 106 Vac, 47 to 63 Hz<br>Opt 220: 191 to 233 Vac, 47 to 63 Hz<br>Opt 230: 207 to 253 Vac, 47 to 63 Hz |

Choose from dozens of supplies and accessories; call HP DIRECT at  
**1-800-452-4844**

# Clean power that won't clean out your budget

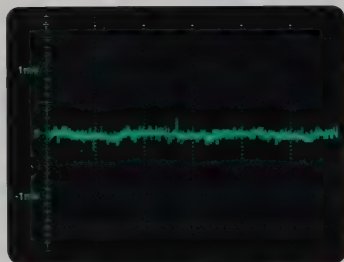
- Nine models, up to 120 V, 6 A
- Constant current and constant voltage modes
- Tight linear regulation, low ripple and noise

Starting at  
**\$300**

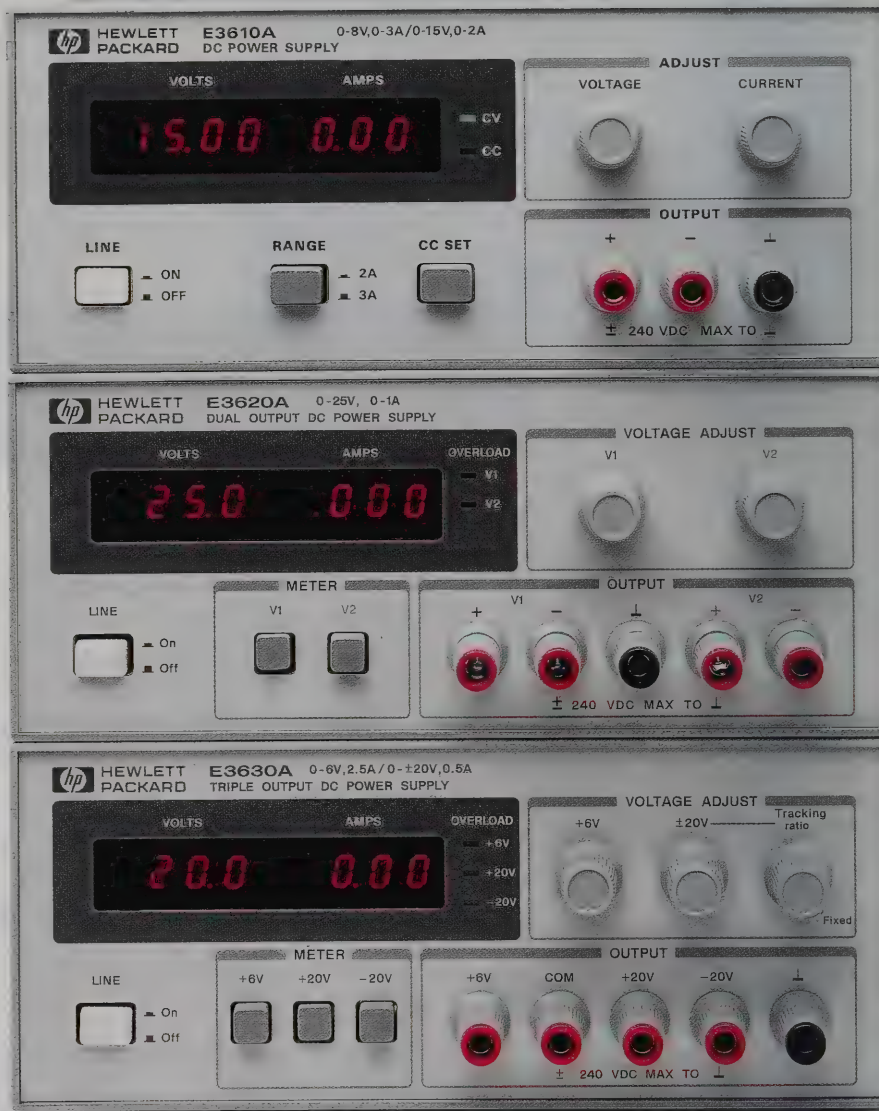
Forget the usual worries about low-cost supplies. The HP E3600-series gives you clean power with dependable regulation and fast transient response. And they turn on and off without overshoot, so you get precise output from start to finish.

The pleasant surprises don't stop there. You can choose constant voltage (CV) mode or constant current (CC) mode, changing automatically based on load. In CV mode, it's easy to set safe current levels for every test. In the HP E3610/11/12A, CV/CC mode lets you preset both current and voltage limits so you can be sure your circuits are getting the levels you think they are.

For even more peace of mind, check out the HP E3614/15/16/17A. Adjustable overvoltage protection — a feature you don't expect on low-cost supplies — makes it easy to keep your circuits out of harm's way. These supplies also use remote sensing to measure voltage at the load, so you count on unsurpassed accuracy during your tests



*With noise this low, you know the HP E3600-series supplies won't burden your circuits with unwanted signals.*



because the supply automatically compensates for voltage drops.

Need multiple outputs from a

single supply? The HP E3620A dual-output supply delivers a pair of 25 V (1 A) outputs (the outputs are completely isolated and independent). The triple output HP E3630A offers  $\pm 20$  V (0.5 A) outputs and a 6 V (1 A) output.



get.

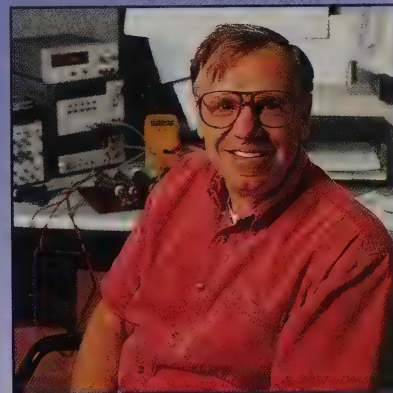
| HP E3600-series dc Power Supplies |  |   |                                 |   |                                |             |           |  |   |
|-----------------------------------|--|---|---------------------------------|---|--------------------------------|-------------|-----------|--|---|
|                                   | HP E3610A  | HP E3611A   | HP E3612A                       | HP E3614A   | HP E3615A                      | HP E3616A   | HP E3617A | HP E3620A                                  | HP E3630A                                   |
| Number of outputs                 | 1  | 1   | 1                               | 1   | 1                              | 1           | 1         | 2  | 3   |
| Output<br>(max. voltage, current) | 8 V, 3 A or<br>15 V, 2 A   | 20 V, 1.5 A or<br>35 V, 0.85 A  | 60 V, 0.5 A or<br>120 V, 0.25 A | 8 V, 6 A  | 20 V, 3 A                      | 35 V, 1.7 A | 60 V, 1 A | 25 V, 1 A<br>25 V, 1 A                     | +6 V, 2.5 A<br>+20 V, 0.5 A<br>-20 V, 0.5 A |
| Features                          | Dual range, 10-turn pots, constant voltage (CV), constant current (CC) modes |   |                                 | Adjustable overvoltage protection, voltage programming, remote sense, rear outputs, 10-turn pots, CV, CC modes; multiple supplies can be connected for tracking or higher power |                                |             |           | Dual outputs isolated, 10-turn pots CV, CL | Tracking, common outputs, CV, CL            |
| Load and line regulation          |  |   |                                 | 0.01% + 2 mV  |                                |             |           |  |   |
| Ripple and noise voltage          |  |   |                                 | <200 $\mu$ Vrms, <2 mVp-p   |                                |             |           | <200 $\mu$ Vrms, <1 mVp-p                  |   |
| Common mode current               |  |   |                                 |   |                                |             |           | Not specified                              |   |
| Transient response time           |  |   |                                 | <50 $\mu$ s following change in output current from full load to half load for output to recover to within:   |                                |             |           |  |   |
| 10 mV                             |  |   |                                 | 15 mV   |                                |             |           |  |   |
| Meter accuracy                    |  |   |                                 | $\pm 0.5\%$ + 2 counts at 25 °C $\pm 5$ °C  |                                |             |           |  |   |
| Meter resolution                  | volts  | 10 mV   | 100 mV                          | 10 mV   | 10 mV (0–20 V), 100 mV (>20 V) |             |           |  | 10 mV                                       |
|                                   | current  | 10 mA   | 1 mA                            | 10 mA   | 1 mA                           |             |           |  | 10 mA                                       |
| Isolation                         |  |   |                                 | 240 Vdc   |                                |             |           |  |   |
| Size                              | 91 mm H x 213 mm W x 319 mm D<br>(3.6 x 8.4 x 12.6 in)                       |   |                                 | 91 mm H x 213 mm W x 400 mm D<br>(3.6 x 8.4 x 15.8 in)  |                                |             |           |  | Same as HP E3610A                           |
| Warranty                          |  |   |                                 | 3 years   |                                |             |           |  |   |
| Price                             |  | \$300.00 ea.  |                                 |   | \$500.00 ea.                   |             |           |  |   |
| Options                           |  | Opt. 0E9 100 Vac $\pm 10\%$ , Opt. 0E3 230 Vac $\pm 10\%$ , Opt. W50 Additional 2-year warranty \$45.00 ea. |                                 |   |                                |             |           |  |   |

**Within budget, without compromise.**

### LAB NOTES

If you're using an external supply to power sensitive circuits that are connected to earth ground, you should be aware of the potential problems caused by common mode current. This is leakage from either terminal of a power supply to chassis ground.

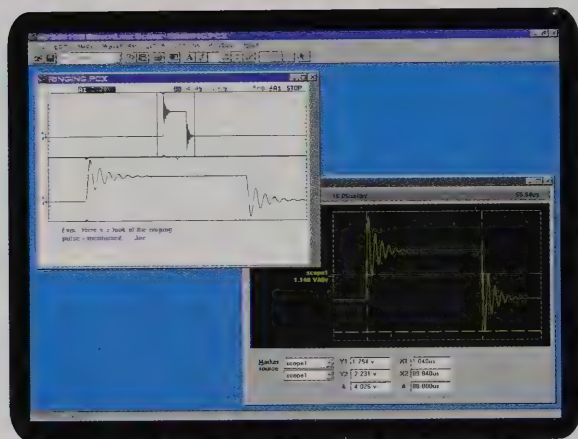
Common mode current or noise isn't usually specified, but if it's a potential concern, make sure you use a supply that does specify it. This current will produce voltages, at the line frequency, across any impedance in the circuit connected to earth ground.



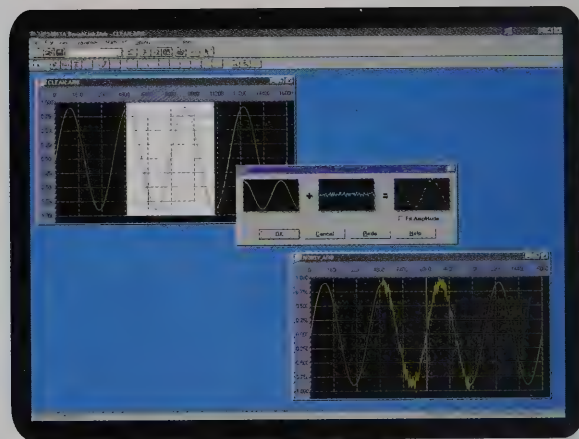
WERNER HAUSSMANN  
R & D Project Manager

You don't need to settle for second-rate power; call HP DIRECT at  
**1-800-452-4844**

# Capture, create, display and document v



*HP BenchLink Scope helps you communicate and analyze measurement results, using the same Windows tools you use for all your documents and presentations.*



*HP BenchLink Arb helps you create just about any waveform you can imagine and download it to the HP 33120A function/arb generator.*

**Documenting tests, communicating with colleagues, reporting to management — the need to do more with your data never ends. The HP BenchLink family of PC connectivity solutions makes these tasks easier by expanding the power of your scope, arb generator, counter or DMM. You can gather instrument data quickly and use it more effectively, and we've done all the programming for you.**

**Move data from your scope to a PC — easily.**

HP BenchLink Scope makes it easy to transfer screen images and waveform data from an HP 54500- or 54600-series scope, as well as the HP 54620A/C logic analyzer. After transferring, you can use HP BenchLink Scope's markers and

*Starting at*  
**\$295**



*HP BenchLink helps you gather instrument data quickly and use it more effectively — and we've done all the programming for you.*

pan-and-zoom\* feature to study waveform data or copy screens and data to other Windows applications. Move screen shots to word processors and presentation packages, or move waveform data (as time/voltage pairs) to spreadsheets or math software. Plus, you can annotate screen images and store them in PCX or TIF formats.

**Create arbitrary waveforms quickly and easily.**

HP BenchLink Arb takes the work out of creating waveforms

for the HP 33120A function/arbitrary waveform generator. Use the drawing tools and waveform library — or use data generated in a spreadsheet or math program. You can also edit and replay waveforms captured with HP BenchLink Scope.

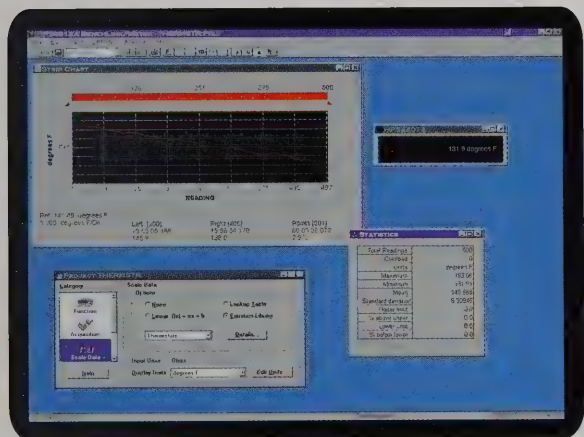
**Computerized data collection — without programming.**

HP BenchLink Meter automates data collection with your HP 34401A DMM or HP 53100-series universal counter. HP BenchLink Meter can help you build a comprehensive test plan with times, test rates and more. Use strip

\*With HP 54645A/D and 54500-series only.



# th HP BenchLink.



*HP BenchLink Meter helps you monitor, analyze and share measurements from both the HP 34401A DMM and the HP 53100-series counters.*

charts, limit tests and other features to monitor incoming data, then move data into other Windows applications for further analysis and archiving. While you're collecting data, you can control the instrument from its front panel or from your PC, whichever is more convenient.

## Add the full HP BenchLink family at a bargain price.

To help you make the most of HP BenchLink's capability, we've bundled all three of these products as the HP BenchLink Suite. You can get all three for a fraction of the price you'd pay to buy them individually.

## Within budget, without compromise.

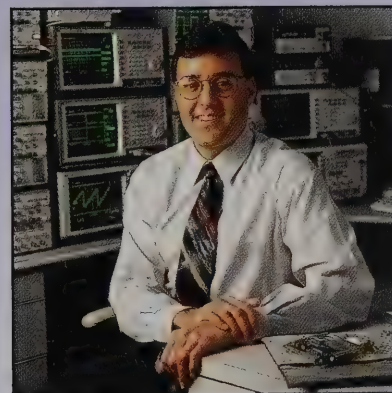
| HP BenchLink   |              |
|--|--------------|
| Ordering information   |              |
| <b>Requirements</b> <ul style="list-style-type: none"> <li>• 486 or better AT-compatible computer<sup>†</sup></li> <li>• Serial port (COM 1, 2, 3, or 4), or IEEE-488 card (HP 82335A/B, HP 82340A, HP 82341A/B/C, or National Instruments AT-GPIB, AT/TNT, or GPIB-PC)</li> <li>• 4 MB or more RAM</li> <li>• MS-DOS 4.01 or later</li> <li>• Windows 3.1 or later<sup>††</sup></li> <li>• MS-compatible mouse</li> <li>• 3.5" high-density floppy drive</li> <li>• 2 MB disk space for each application</li> </ul> |              |
| HP 34810B BenchLink Scope  | \$295.00 ea. |
| HP 34811A BenchLink Arb  | 295.00 ea.   |
| HP 34812A BenchLink Meter  | 295.00 ea.   |
| HP 34820A BenchLink Suite*   | 395.00 ea.   |
| <p>Each HP BenchLink package includes a 3.5" disk and user's guide.</p> <p>* This software suite includes HP BenchLink Scope, Arb and Meter.</p> <p><sup>†</sup> 386 PCs will work, but some features may run slowly.</p> <p><sup>††</sup> HP BenchLink products run under Windows 95, but are not currently supported under Windows NT.</p> <p>Microsoft Windows is a U.S. trademark and MS-DOS is a registered trademark of Microsoft Corporation.</p>   |              |

## LAB NOTES

You need to modify a circuit, but you don't want to pull out your soldering iron before you know you have the right solution.

With HP BenchLink Arb to replay waveforms captured with HP BenchLink Scope, it's easy to perform "what if" analysis. Capture a live signal, modify the waveform, mix in some noise, then use the HP 33120A to re-inject the new test signal. You can test the design change before you do anything drastic. This is just one of the many handy things you can do with HP BenchLink.

To make things as easy as possible, the HP BenchLink series runs on any 486 or better PC with Microsoft Windows 3.1 or later,<sup>††</sup> with either the RS-232 or HP-IB interfaces (both HP and National Instruments IEEE-488 cards are supported).



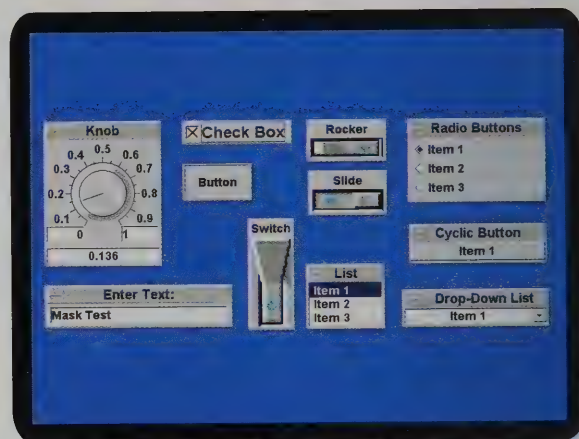
**TONY FELDSTEIN**  
Technical Staff

To find out how easy it is to connect with HP BenchLink, call HP DIRECT at  
**1-800-452-4844**

# Quickly create bench test programs with



*HP VEE's self-explanatory drivers are easy to understand.*



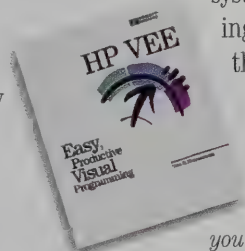
*Choose from a wide variety of intuitive controls and indicators to make data entry and test operation fast and efficient.*

HP VEE's graphical program creation tools reduce the time it takes to develop bench test programs, so you can concentrate on design tasks. Instead of searching through programming manuals for arcane commands and writing code a line at a time, you simply use a mouse to connect screen icons that represent hardware devices and software functions.

With HP VEE, you can control virtually any

programmable device, collecting data with ease. It supports most industry standard interfaces, including HP-IB and RS-232. More than 450 HP instruments come with ready-made drivers.

HP VEE also gives you the tools to create intuitive user interfaces with a wide variety of controls and indicators. You can hide as much of the underlying system complexity as you want, showing only those controls and indicators that are important.



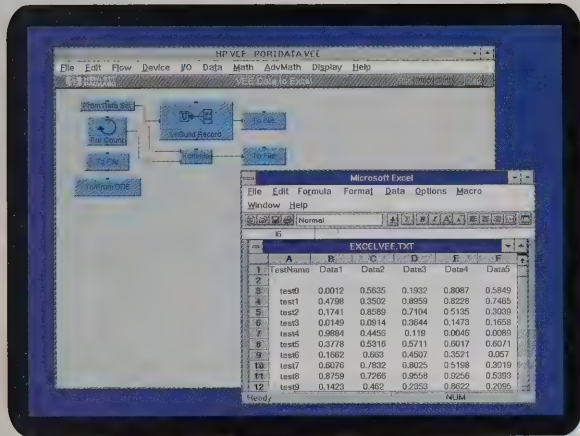
*With HP VEE, you can control and collect data from all your test and measurement instruments.*

In addition to controlling instruments, HP VEE provides a comprehensive set of tools to analyze and display data. The math and engineering functions you're most likely to need are already represented in HP VEE as individual icons. Plus, a test sequencer lets you specify the order of test routines based on run-time results. This combination of control, analysis and sequencing gives you the ability to create sophisticated test programs.

**Within budget,  
without compromise.**

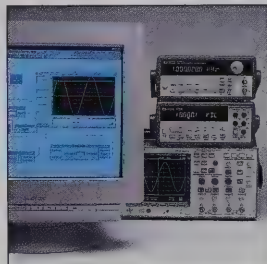


## HP VEE.



*"Programming" with HP VEE is nothing more than connecting icons on the screen. It's also a snap to send test data to spreadsheets and other software packages.*

You don't have to give up existing test programs when you move to HP VEE, either. It's easy to leverage programs written in C/C++, HP BASIC, Visual Basic and other languages. HP VEE can also communicate with a variety of commercial



*With HP VEE, you can easily assemble your own test systems right on your bench top.*

software packages to help you incorporate other specialized functions, such as data visualization and plotting.

HP VEE is available for Windows 3.1 or later, Windows 95, Windows NT, HP-UX and Solaris.

- Graphical program creation cuts test development time by as much as 80%
- Incorporate any instrument or programmable device from any manufacturer
- Easily integrate HP VEE with code from existing test programs

## LAB NOTES

HP and other equipment manufacturers have created several programming standards that help simplify test system development:

**SICL: Standard Instrument Command Library.** Contains both a library of common I/O function calls and hardware drivers for HP-IB, RS-232, MXI, VXI and LANs.

**VISA: Virtual Instrument Software Architecture.** An industry-wide standard I/O library, similar in features and functionality to SICL.

**SCPI: Standard Commands for Programmable Instruments.** Standardizes commands for controlling instruments, from syntax to status queries. Some SCPI commands work the same way for all instruments, others work across specific types of instruments.



NATHAN BERG  
Software Engineer

Find out how HP VEE can make your testing more productive;  
call HP DIRECT at

**1-800-452-4844**

## HP VEE

## Ordering information

## Requirements

- 486 or better AT-compatible computer\*
- Serial port or recommended IEEE-488 card (HP 82335B, HP 82340B, HP 82341C, or National Instruments AT-GPIB, MC-GPIB, GPIB-PCII/IIA)
- 16 MB or more RAM\*\*
- MS-DOS 5.0 or later
- Windows 3.1 (VEE 3.1)
- Windows 95/NT (VEE 3.2)
- 3.5" high-density floppy or CD-ROM drive
- 25 MB disk space for each application

|   |              |
|---|--------------|
| HP E2120D HP VEE 3.2 for Win95 and WinNT  | \$995.00 ea. |
| HP E2120C HP VEE 3.1 for Windows 3.1  | 995.00 ea.   |
| HP 82345D PC Win95/WinNT Automation Kit (HP VEE 3.2, HP 82340B HP-IB card, and cable) | 1250.00 ea.  |
| HP 82345B Win 3.1 Automation Kit (HP VEE 3.1, HP 82340B HP-IB card, and cable)        | 1250.00 ea.  |

|   |           |
|---|-----------|
| Options:  |           |
| Opt AA8 includes 3.5" high-density floppy disks | 50.00 ea. |

\* 386 PCs will work, but some features may run slowly.

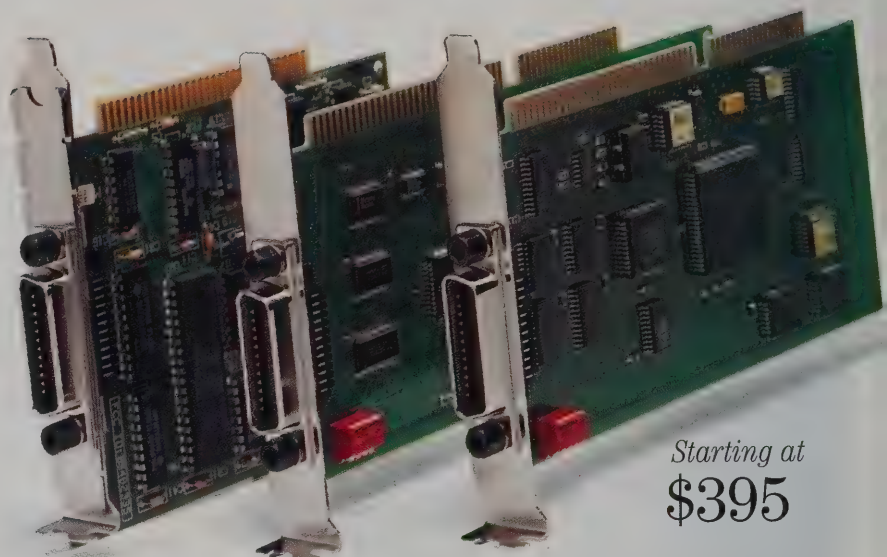
\*\* 8 MB RAM can be used with Win3.1 & Win95, 24 MB recommended with WinNT.

Microsoft Windows is a U.S. trademark and MS-DOS is a registered trademark of Microsoft Corporation.

# Add fast, affordable automation to your PC

Test engineers have been relying on HP-IB for years, and now you can have it on your PC, closely integrated with all your Windows applications. The high-speed HP 82341C provides built-in buffering for fast I/O, making it perfect for demanding applications and multi-instrument systems. The mid-range HP 82340B is ideal for single-task applications with a dedicated PC. The versatile HP 82335B is the right answer for DOS setups, particularly where you want compatibility with existing programs.

The I/O libraries included with the HP 82340B and HP 82341C contain the Standard Instrument Control Library (SICL) and HP's VISA 1.0. This is the I/O library specified by the VXIplug&play Alliance, of which HP is a leading member. The HP Command Library, included with the HP 82335B, supports both DOS and Windows operation.

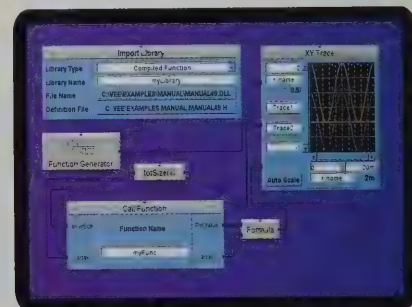


Starting at  
**\$395**

*Combine the speed and power of HP-IB with the visual ease of Windows.*



*Develop test programs right from your PC with a wide variety of languages and programming solutions, including C, Pascal, BASIC and HP VEE.*



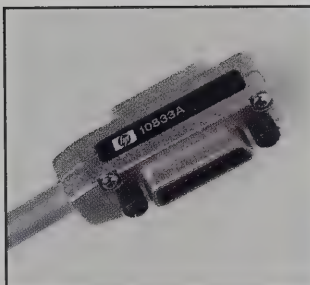
*Control any HP-IB instrument from DOS or Windows.*

|   | HP 82335B HP-IB Card  | HP 82340B HP-IB Card                              | HP 82341C HP-IB Card        |
|---|---|---|-----------------------------|
| <b>Operating system</b>   | DOS, Windows 3.1  | Windows 3.1, NT, 95                               | Windows 3.1, NT, 95         |
| <b>I/O Library*</b>   | Command Library   | SICL / VISA 1.0                                   | SICL / VISA 1.0             |
| <b>Languages</b>  | C, Pascal, BASIC incl. Visual Basic   | C/C++, Visual Basic, HP VEE                       | C/C++, Visual Basic, HP VEE |
| <b>Backplane**</b>  | ISA/EISA (8 bit)  | ISA/EISA (8 bit)                                  | ISA/EISA (16 bit)           |
| <b>Max. I/O speed</b>   | 355 KB/s  | 520 KB/s  | 750 KB/s                    |
| <b>Optional buffering</b>   | No  | No  | Yes                         |
| <b>Warranty</b>   | 1 year  | 1 year  | 1 year                      |
| <b>Ordering information</b>   | HP 82335B HP-IB card for Windows and DOS \$495.00 ea.<br>HP 82340B HP-IB card and SICL for Windows 3.1, Windows NT, and Windows 95 395.00 ea. | HP 82341C High-performance HP-IB card for Windows | \$495.00 ea.                |
| *Applications written using the HP 82335B Command Library software will not run on the HP 82340B or HP 82341C.<br>**One ISA/EISA slot required.<br>Microsoft Windows is a U.S. trademark and MS-DOS is a registered trademark of Microsoft Corporation. |   |   |                             |

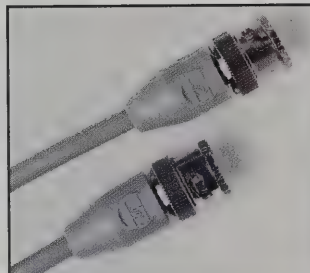


| HP-IB Cables |                          |                |             |
|--------------|--------------------------|----------------|-------------|
| Product No.  | Description              | Length         | Price       |
| HP 10833A    | HP-IB cable              | 1 m (3.3 ft)   | \$90.00 ea. |
| HP 10833B    | HP-IB cable              | 2 m (6.6 ft)   | 100.00 ea.  |
| HP 10833C    | HP-IB cable              | 4 m (13.2 ft)  | 110.00 ea.  |
| HP 10833D    | HP-IB cable              | 0.5 m (1.6 ft) | 90.00 ea.   |
| HP 10834A    | HP-IB to HP-IB adapter * |                | 35.00 ea.   |

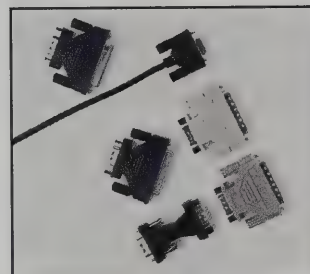
\*Provides additional clearance between HP-IB cable and rear panel of instrument.



| HP 50 $\Omega$ Coaxial Cables |  |        |             |
|-------------------------------|--|--------|-------------|
| Part No.                      | Description  | Length | Price       |
| 8120-1838                     | 2 BNC (m) connectors                                 | 30 cm  | \$23.50 ea. |
| 8120-1839                     | 2 BNC (m) connectors                                 | 61 cm  | 25.00 ea.   |
| 8120-1840                     | 2 BNC (m) connectors                                 | 122 cm | 29.00 ea.   |
| 11000-60001                   | Dual banana plugs                                    | 112 cm | 30.00 ea.   |
| 11001-60001                   | One UG-88 C/U BNC (m) conn. and one dual banana plug | 112 cm | 30.00 ea.   |



| HP RS-232 Cables |   |                |             |
|------------------|---|----------------|-------------|
| Product No.      | Description   | Length         | Price       |
| HP 34398A        | 9 pin (f) to 9 pin (f) plus 9 pin (m) to 25 pin (f) adapter   | 2.5 m (8.2 ft) | \$20.00 ea. |
| HP 34399A        | Adapter kit (contains 4 adapters):<br>9 pin (m) to 25 pin (m) for use with PC or printer<br>9 pin (m) to 25 pin (f) for use with PC or printer<br>9 pin (m) to 25 pin (m) for use with modem<br>9 pin (m) to 9 pin (m) for use with modem |                | 26.00 ea.   |



| HP RS-232 Selection Guide for Basic Instruments*  |                         |                       |            |
|---|-------------------------|-----------------------|------------|
| Instrument  | PC or Printer Connector |                       |            |
|   | 25 pin male             | 25 pin female         | 9 pin male |
| HP 54600-series with<br>HP 54652B/59B <sup>1</sup> , HP E3631A <sup>1</sup> ,<br>HP 34420A <sup>1</sup> , HP 34401A <sup>1</sup> , HP 33120A <sup>1</sup> | HP 34398A               | HP 34398A + HP 34399A | HP 34398A  |
| HP 53131/32/81A <sup>2</sup>  | HP 34398A               | HP 34398A + HP 34399A | HP 34398A  |

<sup>1</sup>Instrument connector is 9 pin (m).  
<sup>2</sup>Instrument connector is 9 pin (m) and is a talk port only.  
 \*This table recommends the compatible RS-232 cable to use when connecting basic instruments in this catalog to a PC or printer.

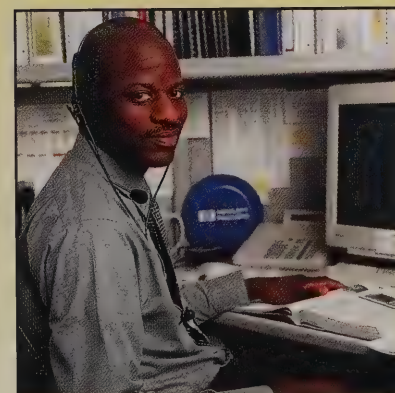
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Start with the hardware. You won't find any other standard interfaces for test automation that are this affordable or this easy to install.

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BSEE, University of Alabama

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# Instrument values that extend all the way into RF.

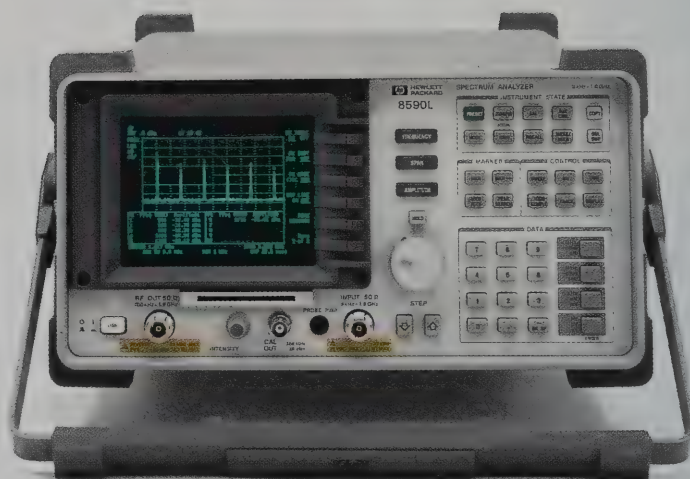
If your test needs extend into the RF range, you can keep looking to HP for instruments that get the job done right. And just like the Basic Instruments line, these RF products deliver the capabilities you need without capsizing your budget.

Here's a quick look at three popular Hewlett-Packard RF tools. The engineers at HP DIRECT can provide all the details on these products and help you select other tools to round out your RF bench — including power meters, LCR meters, test accessories and counters, too.

## HP 8590L portable spectrum analyzer

- Frequency range of 9 kHz to 1.8 GHz
- Frequency accuracy of  $\pm 7.6$  kHz at 1 GHz (and only  $\pm 2.1$  kHz excluding temperature drift)
- Rugged, portable package follows you from lab to factory to field

Only  
**\$8,900**

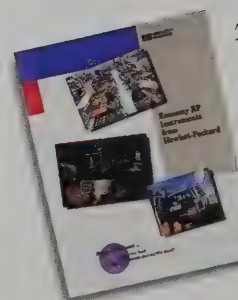


The HP 8590L portable spectrum analyzer features lab-quality measurements in a rugged, easy-to-use spectrum analyzer. It starts with solid measurement capability, including a frequency counter with accuracy of  $\pm 7.6$  kHz at 1 GHz. Then it adds numerous functions that deliver the answers you need day after day, including third-order intercept, adjacent channel power, limit lines and ten peak marker tables.

Plus, the HP 8590L works hard to boost your personal productivity, from the logical front panel to the optional Centronics interface that gives you copies of your measurement results on popular printers. The optional internal tracking generation lets you test a wide variety of RF components.

### HP 8590L Performance Highlights

|                               |   |
|-------------------------------|---|
| <b>Frequency</b>              |   |
| Range                         | 9 kHz to 1.8 GHz  |
| Accuracy                      | $\pm 7.6$ kHz at 1 GHz ( $\pm 2.1$ kHz excluding temperature drift) |
| Resolution bandwidths         | 1 kHz to 3 MHz (10 total)   |
| Noise sidebands               | $\leq 105$ dBc/Hz at 30 kHz offset                                  |
| <b>Amplitude</b>              |   |
| Range                         | -115 dBm to +30 dBm   |
| Accuracy                      | $\pm 1.7$ dB (relative frequency response + IF gain accuracy)       |
| Dynamic range (2nd/3rd order) | 70 dB/80 dB   |
| Gain compression              | -10 dBm (>10 MHz)   |



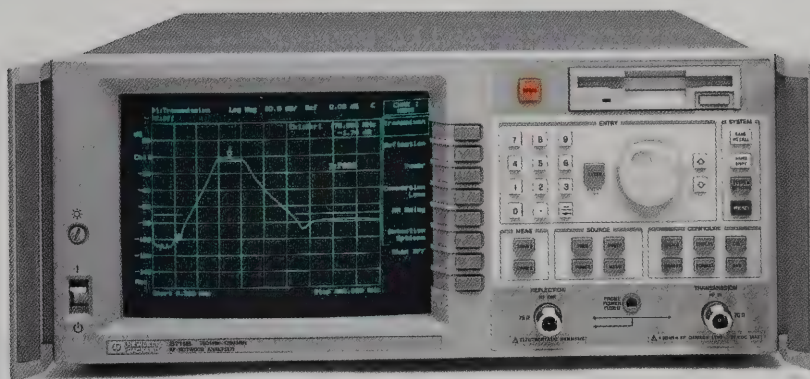
To complete your RF and microwave test bench, ask for a copy of HP's Economy RF Instruments Catalog.



# HP 8711C economy network analyzer family

- Choose magnitude, or magnitude and phase measurements from 300 kHz to 3.0 GHz
- Ideal for testing RF components in cable, broadcast or cellular radio systems
- Rugged design and one-button automation ideal for field service, too
- Now with LAN capability and VGA output

Starting at **\$9,000**



The HP 8711C network analyzers provide a complete device test solution from cable TV bench test to cellular radio. They deliver production-line test speeds without sacrificing accuracy. Repetitive testing is fast and easy with the integrated transmission/reflection test set, display markers, limit lines and

optional multiport test sets and Instrument BASIC. With 100 dB dynamic range, broadband detection, 1 Hz resolution and 40 dB corrected directivity, you'll get results you can count on, too.

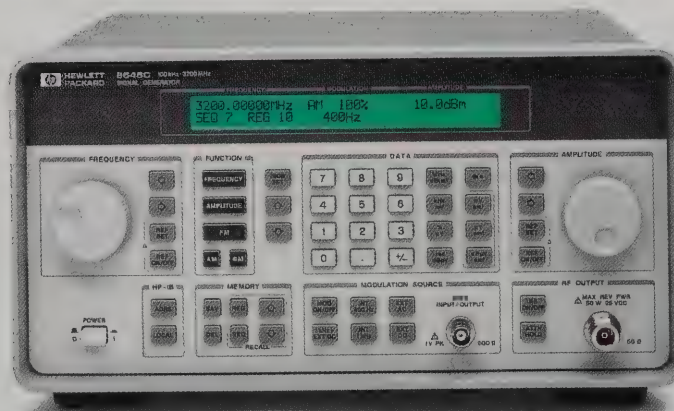
## HP 8711C Family Performance Highlights

|                             |  |
|-----------------------------|--|
| <b>Frequency range</b>      | 300 kHz to 1.3 GHz (HP 8711C/12C)<br>300 kHz to 3.0 GHz (HP 8713C/14C) |
| <b>Measurement type</b>     | Magnitude (HP 8711C/13C)<br>Magnitude and phase (HP 8712C/14C)         |
| <b>Frequency resolution</b> | 1 Hz   |
| <b>Dynamic range</b>        | >100 dB (narrowband)<br>>60 dB (broadband)                             |
| <b>Directivity</b>          | 40 dB  |

# HP 8648A/B/C/D economy RF signal generators

- New pager test option for HP 8648A
- Ideal for in-channel receiver tests
- FM, AM and PM
- Superior output-level accuracy:  
±1 dB down to -127 dBm

Starting at **\$5,865**



Count on the HP 8648 family of RF signal generators to provide clean, dependable signals up to 4.0 GHz. With the addition of a one-hand remote controller, the simple-to-use semi-automated interface will reduce

test time, too. Optional pulse and high-power outputs on the HP 8648B, 8648C and 8648D expand your test options.

## HP 8648A/B/C/D Performance Highlights

|                                   |  |
|-----------------------------------|--|
| <b>Frequency range</b>            | 9 kHz (typical) to 4 GHz (HP 8648D)<br>100 kHz to 3.2 GHz (HP 8648C)<br>100 kHz to 2.0 GHz (HP 8648B)<br>100 kHz to 1.0 GHz (HP 8648A) |
| <b>Output level</b>               | -136 dBm to +10 dBm (up to +20 dBm ≤2.5 GHz)   |
| <b>Level accuracy</b>             | ±1 dB down to -127 dBm (≤2.5 GHz)  |
| <b>Spectral purity at 500 MHz</b> | SSB phase noise -120 dBc/Hz (at 20 kHz offset typical)   |
| <b>Residual FM</b>                | <4 Hz (249 to 501 MHz)<br><7 Hz (<249 MHz, 501 and 1001 MHz)<br><14 Hz (<2001 MHz)<br><28 Hz (≤4000 MHz)                               |

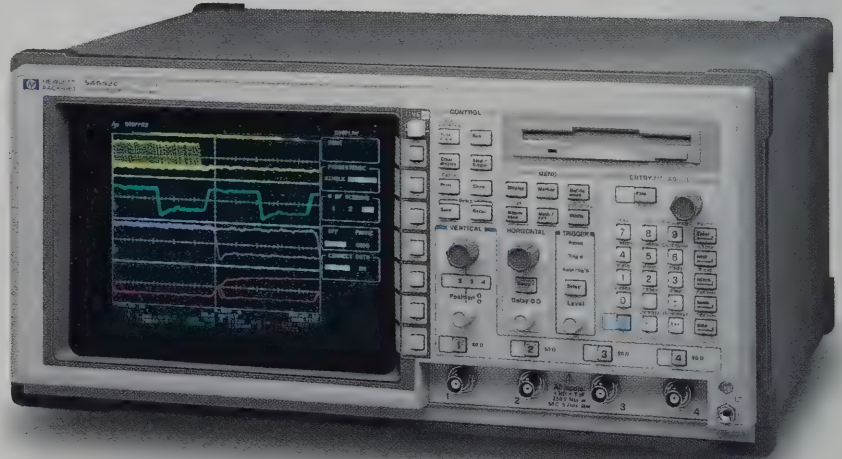
# Extra-performance instruments

Chances are the Basic Instruments family covers your test and measurement demands. For those times when you need an extra level of speed or precision, HP has a full range of

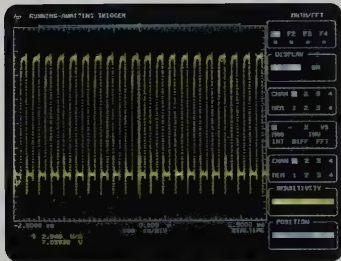
high-performance solutions. They're designed with the same emphasis on customer value you see in our Basic Instruments. Here are just three examples of the high-performance products we offer.

## HP 54520/40-series scopes

- Up to 2 GSa/s, 32 K memory and 1 ns peak detect on each channel
- Standard floppy disk drive, FFT and advanced triggering
- Application features include limit testing, sequential single shot with up to 400 K memory and optional telecom mask testing
- Large color or monochrome display



Starting at \$9,500



*Scopes with inadequate memory show you only a small fraction of...*



*... what you'll see with the HP 54520/40-series.*

The HP 54500-series combine the performance and features you need to reduce hardware design and troubleshooting time.

With 32 K memory per channel, these scopes let you maintain higher resolution over longer periods of time.

And when you're armed with two or four channels running at up to 2 GSa/s (and 1 ns peak detect), you can catch hard-to-find problems before they catch you. Sequential single-shot mode captures and time-tags successive pulses separated by long dead times.

### HP 54520/40-series Performance Highlights

|                      |                                 |
|----------------------|---------------------------------|
| Maximum sample rate  | from 1 GSa/s to 2 GSa/s         |
| Repetitive bandwidth | 500 MHz                         |
| Channels             | 2 or 4 (simultaneously sampled) |
| Peak detect          | ≥1 ns                           |
| Memory depth         | 32 K/channel                    |

To solve the most demanding problems, call HP DIRECT at  
**1-800-452-4844**



# HP 3458A multimeter

- 8½ digits of resolution
- 8 ppm basic one-year accuracy on dc volts (4 ppm optional)
- High throughput — up to 100,000 readings/second

Only  
**\$6,730**



When you can't compromise on measurement performance, the HP 3458A multimeter delivers 8½ digits of resolution and 0.1 ppm linearity. Plus, choose from more than a dozen measurement modes, including both analog and sampling true-rms ac volt

techniques, as well as high-speed digitization with sub-sampling.

And if you need to measure low-level signals with confidence, ask about the HP 34420A nanovolt/micro-ohm meter and its 100 pV/100  $\mu\Omega$  sensitivity.

| HP 3458A Performance Highlights |   |
|---------------------------------|---|
| <b>dc Volts</b>                 | 100 mV to 1000 V ranges<br>10 nV sensitivity<br>0.1 ppm transfer accuracy                 |
| <b>ac Volts</b>                 | 1 Hz to 10 MHz bandwidth<br>Analog, random and sub-sampled modes<br>100 ppm best accuracy |
| <b>Ohms</b>                     | 10 $\Omega$ to 1 G $\Omega$ ranges<br>2- and 4-wire with offset compensation              |
| <b>Features</b>                 | Math/statistics, 20 kB memory, self-adjusting autocalibration                             |

# HP 8110A 150 MHz pulse generator

- Master/slave capabilities for multichannel tests
- Variety of signal modes, including bursts and patterns
- Modular design lets you add the functions you need

Starting at  
**\$10,200**

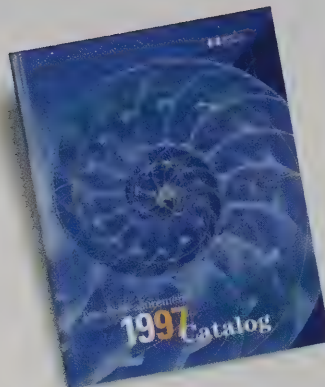
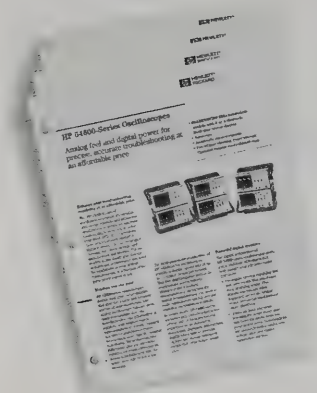


The ability to simulate real-world digital signals with precise edge positioning make the HP 8110A the ideal companion for your scope or logic analyzer and the perfect

generator for VFO and PLL testing. Signal creation tools let you set up such key test signals as irregular pulse widths, pulse droop, groundbounce and multilevel waveforms.

| HP 8110A Performance Highlights |   |
|---------------------------------|---|
| <b>Frequency</b>                | 1.00 Hz to 150 MHz                      |
| <b>Resolution</b>               | 3 digits (10 ps best case)              |
| <b>Output level</b>             | up to 20 V                              |
| <b>Transition time</b>          | 2.0 ns, (50 $\Omega$ into 50 $\Omega$ ) |
| <b>Burst length</b>             | 2 to 65,536 or double pulses            |
| <b>Patterns</b>                 | 2 to 4,096 bits                         |

# Learn more about HP test and measurement solutions.



## Detailed specs and performance data for most Basic Instrument products.

Get complete specifications on the HP 54600-series scopes, HP 33120A function/arb generator, HP 34401A digital multimeter, HP 53131A and HP 53132A universal counters, HP 970-series handheld multimeters, HP E3600-series power supplies, HP 54620A/C logic analyzer, and HP 34800-series BenchLink software. Ask for HP publication numbers:

- 54600-series 5964-9339EUS
  - 33120A 5964-0146EUS
  - 34401A 5964-0145EUS
  - 53100-series 5964-0385EUS
  - 970-series 5964-0384EUS
  - E3600-series 5964-0383EUS
  - 54620A/C 5963-3565EUS
  - BenchLink 5965-1511EUS
- (product numbers HP 34810B, HP 34820A, HP 34811A, HP 34812A)

We can also provide technical data sheets on any other HP products in this catalog.

## The complete guide to all HP test and measurement products.

The 1997 Test & Measurement Catalog (HP pub. #5965-3053EUS) contains information on all HP analyzers, sources, communication test equipment, and systems products (including VXIbus systems, board test, semiconductor test, and system controllers). In addition to product data, you'll find information about customer service, financing, leasing and rental.

## Organize your instrumentation with an HP rack system.

The Rack Solutions Catalog (HP pub. #5963-1052EUS) highlights all the racks, adapters and accessories you need to build an efficient test and measurement system. You'll find information on 19-inch EIA racks, HP Testmobile carts, cables and accessories, uninterruptable power supplies, and furniture. The catalog also describes HP's system integration services and provides helpful guidelines for configuring rack systems.



**For answers to any test and measurement question, call HP DIRECT at**  
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 5703 ☐ Oscilloscopes  
 5702 ☐ Counters  
 5301 ☐ Pulse/Function Generators  
 5711 ☐ Bench Power Supplies  
 5710 ☐ System Power Supplies  
 5706 ☐ Logic Analyzers  
 5704 ☐ Meters  
 52 ☐ Data/Telecommunications Testers  
 5107 ☐ Microwave Power Meters  
 5105 ☐ Spectrum Analyzers  
 5106 ☐ Network Analyzers  
 5501 ☐ Data Acquisition & Control  
 5502 ☐ Dynamic Signal Analyzers  
 56 ☐ Computer-Aided Test Software  
☐ Other

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 12 ☐ Mechanical Engineer  
 15 ☐ Industrial Engineer  
 18 ☐ Production Engineer  
 1E01 ☐ Engineering Technician  
 54 ☐ Purchasing Agent  
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 35 ☐ Communications Equipment  
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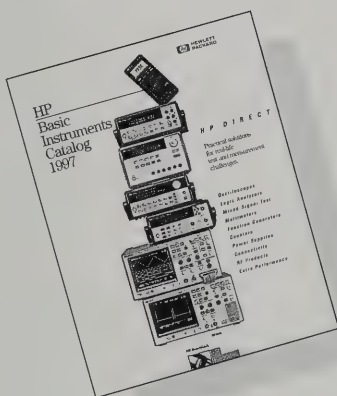
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 74 ☐ Electronic Equipment Rental  
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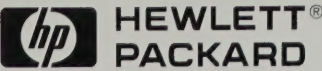
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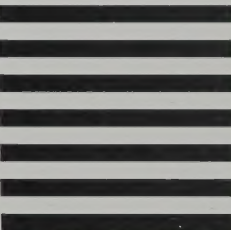
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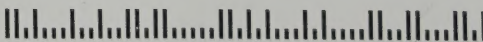


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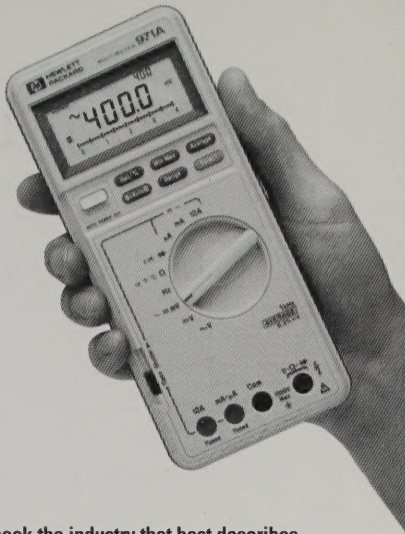
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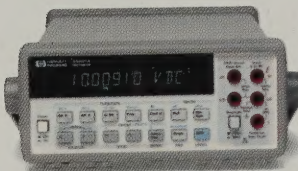
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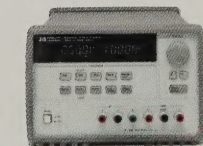
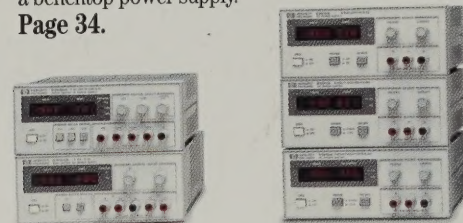


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HP 34401A  
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HP E3600-series power supplies.  
Nine models for clean output from a benchtop power supply. Page 34.

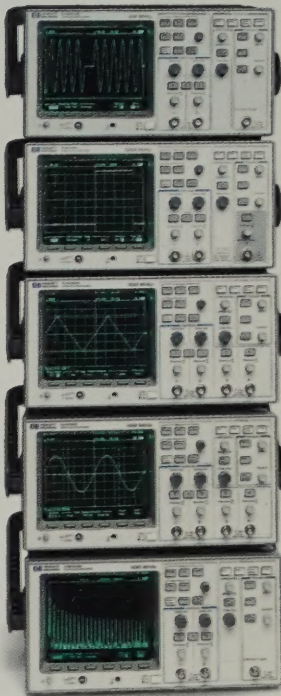
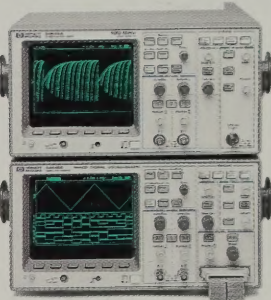


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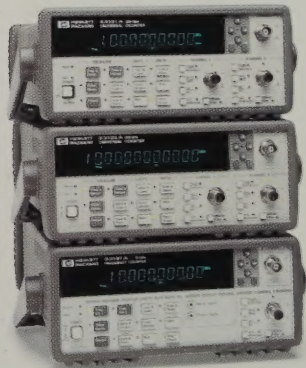
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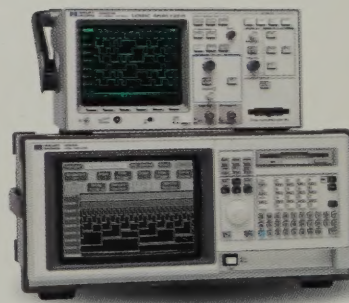
HP 54645A/D  
Mixed signal oscilloscope.  
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HP 54600-series oscilloscopes.  
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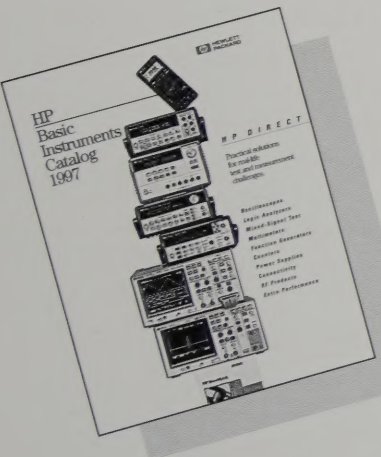
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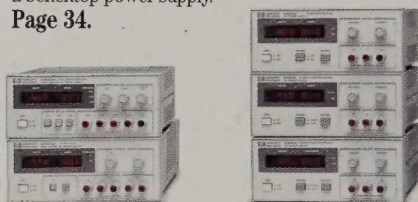
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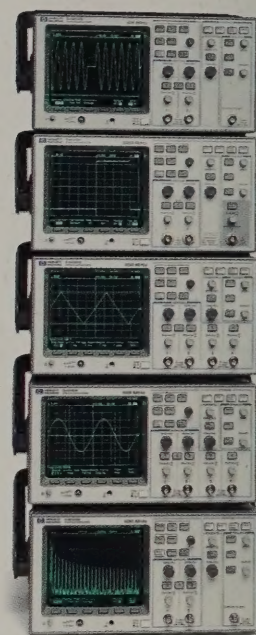
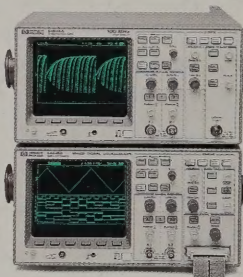
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**HP E3600-series power supplies.**  
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**Page 34.**



**HP 54645A/D**  
Mixed signal  
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See scopes with  
innovative new  
ways to measure.  
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**HP 54600-series oscilloscopes.**  
Analog feel and digital power.  
**Page 6.**



**HP E3631A triple-output dc power supply.**  
Precise, programmable power and versatility —  
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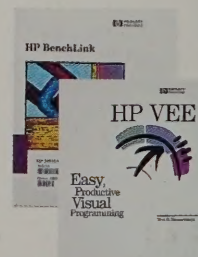


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**HP 1664A logic analyzer. Page 20.**

**Function  
generator.**  
What kind of wave-  
form do you need?  
See **page 28** for  
the **HP 33120A.**



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